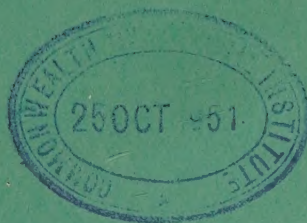


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THE
THIRD ANNUAL REPORT
OF THE
RESEARCH DEPARTMENT
OF THE
INDIAN COFFEE BOARD
(1949-50)



PUBLISHED BY THE DIRECTOR OF RESEARCH
INDIAN COFFEE BOARD, BALEHONNUR P.O.
South India

Price : Re. 1/-

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THIRD ANNUAL REPORT OF THE RESEARCH DEPARTMENT OF THE INDIAN COFFEE BOARD

(1949—1950)

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INTRODUCTORY

1. **Administration.** I continued to be in charge of the Research department throughout the year. Dr. N. G. Chokkanna, Mr. S. Sundaram and Mr. R. L. Narasimhaswamy continued to be the Chemist, Agronomist and Assistant Botanist respectively. Mr. S. Sundaram was in charge of the sub-station, Chethalli, in addition to his duties as Agronomist. Mr. T. V. Pattabhiraman continued to be the Asst. Plant Pathologist till the 4th June 1950 when he was transferred to Balehonnur to fill the post of Liaison Officer. Mr. James Colaco loaned by the Madras Agricultural Department for appointment as Superintendent, Coffee Research Station, Balehonnur, joined duty on the 1st February 1950. Sri H. N. Gundappa, Farm Assistant on foreign service from the Mysore department of Agriculture reverted to his mother department. Due to lack of sufficient laboratory and living accommodation, the recruitment of the full compliment of sanctioned staff had to be deferred during the period.

2. **Expansion and extension activities.** The additional laboratory building and 8 staff quarters at Balehonnur were under construction during the period and were nearing completion. Five blocks of 25 labour quarters were practically completed at the sub-station, Chethalli. The construction of two blocks of 12 labour quarters was commenced at Balehonnur. A 12,000 gallon concrete storage tank and a 6,000 gallon steel overhead tank were constructed at Balehonnur. Two electric driven pumps were installed at the headquarter station and 2½ inch mains and additional distributory system laid to augment the limited water supply at the station. The old pulper house at Chethalli was renovated and a disc pulper installed. A masonry embankment was constructed to impound sufficient water for pulping purposes. For the first time, pulping of coffee was done at the sub-station. Seven acres of old coffee were cleared at the sub-station and 6 acres replanted to arabica selections. Another 3 acres were cleared for planting in 1950 season. Besides this, one acre of robusta was planted on a patchy area in the orange garden. About 80 acres of scrub jungle were cleared at the sub-station to provide sites for the proposed residential quarters and to accommodate the water supply system, the layout of which was impending. There were no additions to the cultivated area at Balehonnur.

3. **Season and Crop.** (a) *Balehonnur*—The weather experienced was very unusual. Unlike in previous years, when both July and August used to be wet with practically no bright days, there were 5 bright days in July and 14 in August. Upto the middle of the month, September was fairly normal with bright mornings, warm afternoons and characteristic downpours for a short while in the afternoons. The middle of the month experienced a recrudescence of the monsoon. During October typical N. E. monsoon prevailed with bright, warm mornings and cloudy afternoons with short spells of rain towards the late afternoons. The rains continued into November. Early in November, there occurred a cold spell during

which the minimum temperature went down to 52° F. Later, the weather warmed up and became pleasant towards the end of the month. The weather conditions were favourable for plant growth and the new flush produced on coffee was quite satisfactory. The day temperatures rose steadily from January to March and during the latter month the usual cool and pleasant spring weather was non-existent. The days were quite bright and the sky almost devoid of clouds except for a few days in January and in the third week of February. In March, however, although the forenoons were bright, afternoons witnessed gathering clouds which were dispersed in the evenings by a cool breeze. Unusually early blossom showers amounting to 74 cents occurred on the night of the 19th February and brought out about 75 per cent of the arabica blossom and practically the whole of that of robusta. A long dry spell that prevailed for nine weeks after the rains on the 19th February was broken by a rain-fall of 25 cents on the 23rd April. This was followed by periodical rains until the beginning of June when the S.W. monsoon set in. Owing to a depression in the Bay, the S.W. monsoon made an early advance and typical monsoon rains commenced from the 31st May. There was a waning in the intensity of the monsoon after the first few days till the middle of June. This break was helpful for completing fair weather operations like spraying which could not be commenced by the beginning of May as the second blossom came out towards the beginning of May. The rains that occurred towards the end of April helped to develop some of the undeveloped spikes which failed to blossom in March and a second blossom after an interval of two months resulted. This helped to make good to some extent the losses from the severe drought that followed the first blossom. The 1951 crop is estimated at 11.5 tons.

(b) *Chethalli*: Although monsoon conditions prevailed during the period July-September, the rainfall was below normal and periodical breaks of bright weather occurred. October was moist with good N. E. monsoon rains, the total rainfall being 5.60 inches as against 3.83 inches in October 1948. The weather conditions were favourable for all the crops. Blossom showers amounting to 71 cents occurred on the 20th and 21st February 1950. This brought out the arabica and robusta blossom. The continued drought following the first blossom showers affected seriously the crop position and a reduction of 30 per cent on the original estimates is anticipated. The April rains however brought out a second blossom and this has helped to make good the losses by about 15 per cent and a crop of about 10 tons is expected. Arabica in open patches and robusta which flowered in February suffered severely on account of the drought. The formation of new flush was also delayed and consequently spraying had to be postponed to the end of May.

The meteorological data are furnished as appendices I, II and III.

RESEARCH

I. BOTANY

A. Breeding.

4. The most important feature of the year's work was the re-orientation of the policy of breeding and selection based on the recommendations of an Expert Committee* appointed by the Board which reviewed the progress of work done in South India and elsewhere in other coffee growing countries and formulated proposals that were calculated to improve yields of existing planta-

*The Committee consisted of Rao Bahadur V. Ramanathan, Deputy Director of Agriculture (Retired), Dr. D. V. Bal, Director, Institute of Plant Industry, Indore (Retired) and Mr. K. M. Thomas, Director of Research (Co-opted).

tions in the shortest period possible. Their recommendations consisted mainly of (1) the supply of hybrid seeds produced from controlled pollination of parents which are known to produce vigorous progeny, (2) the detection and vegetative propagation of clonal material from outstanding bearers, (3) comparative trials of clonal plants obtained from the best performers with a view to further selection from among these and (4) an organized search and detection of the best bearers in private estates to supplement the material obtained at the Research Stations. This meant that without prejudice to the long-term programme of evolving desirable types which breed true from seed, a special effort is to be made to pick out the best yielders whose yield performances over a period of years are available from the records on the station, and progressively propagate such outstanding clonal material vegetatively so that growers may have the benefit of these high yielders in the space of about thirteen years. Thanks to the unstinted assistance received from Rao Bahadur Sri V. Ramanathan, one of the members of the Expert Committee, a preliminary selection of the best yielders on the station was made by a study of the individual yields of a large population maintained for a period ranging from 6 to 11 years. The primary criterion employed for this selection was that the average yield of an individual culture should be more than twice the yield of the plant population in the family. While an exception had to be made in the case of certain families with high averages, in several cases the yields of selected cultures surpassed the above criterion. These cultures are to be propagated vegetatively by rooting of sucker cuttings and planted out in randomised and replicated plots so that the best performers could be singled out for further vegetative multiplication and distribution to growers.

5. (i) *ARABICA*. At Balehonnur an effort was made to discover suitable combinations of individual parents which produce the largest number of plants with such desirable characters as growth-vigour, yield and disease resistance. In addition to this, further hybridization and selfing of desirable types was continued. Details are furnished below:—

TABLE I. Breeding of Arabica coffee at Balehonnur (Mysore)

No.	Method.	Purpose.	Procedure adopted.
1.	Hybridisation between two desirable parents.	To secure best combination to produce highest yield and vigour.	1. (a) S. 26 X 583.1/9 (b) " X 583.3/7 (c) " X 583.5/16 (d) " X 580.2/16 (e) " X 446.2/9 2. (a) S. 31 X 583.1/9 (b) " X 583.3/7 (c) " X 583.5/16 (d) " X 580.2/16 (e) " X 446.2/9
2.	Selection from self bred progeny of hybrids.	Testing of promising cultures in family blocks.	Selection from 1st, 2nd and 3rd generations of S. 26
3.	Selfing of desirable types.	To produce seed for regional nurseries.	1. 37 plants in S. 795 family (sibs 1-37) were covered with muslin bags when they were in blossom. 2. 45 plants in S. 645 family (sibs 1-45) were covered with muslin bags when they were in blossom. 3. 47 plants in S. 838 family (sibs 1-47) were covered with muslin bags when they were in blossom.

At Chethalli, the policy of raising foundation stocks of breeding material was pursued and collections of plant materials obtained from Balehonnur and

Ghattadhulla. The seedlings and rooted 'sucker' cuttings obtained from 8 families of Balehonnur selections were planted and the observations made on them are furnished below.

TABLE II. Breeding of Arabica coffee at Chethalli (Coorg)

No.	Selections	Procedure adopted	Remarks
1.	Selections under regional nursery scheme : S. 288, S. 795, S. 531 X Kents S. 26 X Kents.	Grown in non-replicated plots varying from 2 acres to $\frac{1}{4}$ acre.	All of them are of medium vigour and free from leaf disease.
2.	Selections under replicated trials— S. 288, S. 795, S. 645, S. 446.	Laid out in Latin square, 4 x 4 with 12 x 8 plants in each plot.	S. 446 had very slight leaf disease. The rest are free. Outstanding for vigour is S. 446 and S. 795, while S. 288 is of poor growth. In survival value under the dry conditions of the year the first two lead. The percentage of mortality in S. 446, S. 795, S. 645, S. 288 being 3.38, 11.71, 19.27 and 30.71 respectively.
3.	Selections under non-replicated tests, S. 702, S. 838	Planted in 10 and 5 cents respectively.	Both are of good vigour and free from leaf disease.
4.	Rooted cuttings of S. 645, S. 31 and S. 795 got from Balehonnur	A few plants in each planted.	There was some mortality possibly due to late planting in October and extreme dry conditions that followed.

Devamachi hybrids : Seed material from 8 selections from the progeny of interspecific hybrids between arabica and robusta which resemble arabica were sown in strip plots for future studies. A fresh batch of promising hybrids and second generation crosses with Kents were also raised at the Sub-station. The details are given in table below :—

TABLE III

(a) Selections	Procedure adopted	Remarks
Devamachi hybrids (natural cross between robusta and arabica) Selections sown— D 4, D 8, D 15, D 23, D 26, D 32, D 52, and M 13.	Sown in small strips.	In their morphological features these cultures mostly resemble arabica. They are free from leaf disease.
(b) <i>Devamachi hybrids</i>	<i>Crosses within Devamachi hybrids</i>	<i>Crosses with Kents</i>
D	D x 26	D x A (Kent)
5	D x 69	8 x A (Kent)
8	D x 8	
12		
16		
26		

The crosses are intended to remove specific defects in otherwise good parents, and also with a view to find out if better yielders could be obtained combining vigour and freedom from disease.

Field studies of advanced generation of hybrids: The following were planted at Balehonnur.—

<i>Seedlings produced from:</i>	<i>No. of seedlings planted.</i>
4th selfed generation of S. 26.	357
5th -do- -do-	835
F ₄ of S. 26 x Maragotype	453
F ₄ of S. 228 x Maragotype	206

A further batch of seedlings was raised from the seeds produced from the following combinations for the study of their characters:—

<i>Seeds produced from:</i>	<i>No. of seedlings raised.</i>
F ₂ of S. 26 x S. 47 ...	100
F ₂ of 360 x 288 ...	100
F ₂ of 359 x S. 31 ...	100
F ₃ of 288 x 286 ...	100
F ₄ of S. 26 x Kent ...	160
288 x (288 x Kent) ...	200
S. 26 x (S. 26 x Maragotype)	200
288 x (288 x Maragotype) ...	350
(S. 26 x Kent) x (288 x Maragotype).	300
(288 x Kent) x (288 x Maragotype)	100
333 x (359 x 333) ...	110
645 x (353 x 333) ...	70
(S. 48 x S. 31) x 645. ...	200
F ₂ of 288 x Maragotype ...	100
Other selections ...	425

Character studies of some arabica selections: The following table furnishes the analyses of the produce from clonal material of S. 26 and S. 31.

TABLE IV.—Character studies of some arabica selections (Balehonnur)

Sl. No.	Selections	Percent of triage			Per cent of 'A' grade			Percent of pea-berry			Wt. of 100 'A' grade beans, gms.		
		1947	1948	1949	1950	1947	1948	1949	1950	1947	1948	1949	1950
1	S 26 (clones)	36.8	22.5	12.6	12.4	40.2	21.3	28.0	46.7	15.1	37.6	24.0	31.4
2	S 31 (clones)	35.3	11.4	8.9	5.0	44.9	51.2	31.2	55.1	11.4	23.9	38.3	27.5
											18.7	18.5	14.3
											17.8	17.8	17.2
													19.2
													18.6

These observations confirm the conclusions recorded in the previous report that the production of various grades of beans is apparently the result of seasonal factors with little or no relation to the genetic constitution of the plant.

Yield records of the latest Balehonnur selections : The following table furnishes the yield records of individual selections from various families as compared to the family averages.

TABLE V.—Yield records of the latest Balehonnur arabica selections.

YIELD OF RIPE CHERRY IN OUNCES															Estimated average in terms of clean coffee per acre (1200 plants) in cwt.	
Selection No.															Average	
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
BA. 1 (288-2/5)	...	145	87	97	68	100	154	124	224	133	60	1	51	103	104	11.6
" 2 (281-2/7)	...	48	27	95	49	142	166	114	156	123	58	84	77	133	98	10.9
" 3 (288-2/9)	...	27	86	39	106	61	119	50	156	178	19	88	40	185	89	9.9
Mean of 71 sibs.	...	45	45	24	43	48	57	25	75	24	21	53	17	56	41	4.6
BA. 4 (329-3/4)	...			59	69	114	132	4	120	34	180	135	Not re-	Not re-	94	10.5
" 5 (3.9-6/12)	...			95	72	108	72	16	180	80	136	95	corded.	corded.	95	10.6
" 6 (329-6/14)	...			74	94	152	62	14	148	60	76	121	do	do	89	9.9
Mean of 112 sibs.	...			43	32	59	27	6	54	31	14	53	do	do	35	3.9

BA. 7 (370-1/2)	...			3	6.2	89	72	44	82	38	24	220	Not re- corded.	Not re- corded.	70	7 8
Mean of 75 sibs.	...			25	57	40	38	16	23	20	23	35	do	do	31	3.5
BA. 8 (327-2/10)	...			74	34	202	102	74	162	80	96	172	Not re- corded.	120	112	12.5
" 9 (327-3/10)	...			13	69	144	192	56	260	24.2	142	138	do	80	104	11.6
" 10 (327-4/15)	...			68	41	170	74	72	150	112	104	240	do	80	112	12.5
" 11 (327-5/5)	...			84	23	206	84	32	180	80	160	158	do	88	109	12.2
" 12 (327-6/4)	...			15	28	146	118	140	218	100	120	214	do	116	122	13.6
Mean of 390 sibs.	..			28	23	81	41	37	111	36	64	68	86	43	56	6.3
BA. 13 (333-4)	...			118	55	137	98	109	206	124	160	168	88	108	125	13.9
" 14 (333-6)	...			79	125	166	87	80	324	64	212	110	44	160	132	14.7
" 15 (333-7)	...			48	106	137	57	96	240	84	138	138	72	89	110	12.3
" 16 (333-8)	...			208	84	260	32	95	266	86	110	168	115	214	149	16.6
" 17 (333-14)	...			102	102	93	150	102	219	78	165	106	137	189	131	14.6
" 18 (333-15)	...			70	100	94	86	84	105	107	155	112	134	122	106	11.8
Mean of 14 sibs.	...			57	62	95	65	73	161	59	113	103	58	126	89	9.9
BA. 19 (645-1/6)	...										244	126	65	63	126	14.1
Mean of 90 sibs.	...										64	64	18	36	46	5.1
BA. 20 (644-1/13)	...										132	156	64	158	128	14.3
Mean of 32 sibs.	...										49	90	26	46	53	5.9

TABLE V.—Yield records of the latest Balehonnur arabica selections. (Contd.)

Selection No.	YIELD OF RIPE CHERRY IN OUNCES														Estimated average in terms of clean coffee per acre (1200 plants) in cwt.
	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	Average	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
BA. 21 (583-1/9)	...							180	162	152	328	Not re-	230	210	23.4
" 22 (583-2/4)	...							140	72	48	184	corded.	86	106	11.8
" 23 (583-5/11)	...							144	138	67	200	do	70	124	13.8
" 24 (583-6/12)	...							116	34	42	304	do	41	107	11.9
" 25 (583-7/14)	...							160	72	38	184	do	92	109	12.2
Mean of 128 sibs.	...							61	55	21	145	do	38	64	7.1
BA. 26 (353-8/15)	...		31	128	42	90	54	112	128	44	148	Not re-	Not re-	86	9.6
" 27 (353-7/6)	...			148	166	182	160	167	196	22	302	corded.	corded.	149	16.6
" 28 (353-9/13)	...		5	78	94	88	28	96	144	20	194	do	do	83	9.3
Mean of 336 sibs.	...		13	47	33	31	23	40	41	13	78	do	do	35	3.9
BA. 29 (576-1/2)	...							74	206	6	178	5	18	81	9.0
Mean of 48 sibs.	...							48	64	20	108	1	7	41	4.6
BA. 30 (580-2/13)	...							176		156	100	11	Not re-	89	9.9
Mean of 48 sibs.	...							62	22	52	89	6	do	46	5.1

BA. 31 (585-1/14)									120	13	12	192	Not re- corded.	32	74	8.2
Mean of 60 sibs.									61	24	19	66	do.	14	37	4.1
BA. 32 (373-1/3)					82	68	78	54	110	36	118	28	Not re- corded.	Not re- corded.	72	8.0
Mean of 32 sibs.					39	34	25	17	33	5	23	32	do.	do.	32	8.0
BA. 33 (526-4/15)							56	24	128	145	Not re- corded.	40	Not re- corded.	do.	79	8.8
Mean of 96 sibs.							30	6	59	19	do	19	do.	do.	27	3.0
BA. 34 (434-4/11)							80	143	58	21	104	104	27	22	62	6.9
Mean of 96 sibs.						53	25	51	41	50	13	19	22	27	33	3.7
BA. 35 (S. 26)	299	115	177	270	224	251	88	277	93	120	96	40	46	161	18.0	
BA. 36 (S. 31)	103	98	80	67	93	125	64	372	51	114	152	54	108	99	11.1	

N.B.—For calculating the clean coffee, 6 lb. of ripe cherry has been taken to yield 1 lb. of clean coffee.

Selection from private estates.—A start was made in marking out desirable mother plants in private estates and preliminary selection of 6 plants was made on Netraconda estate (Mysore). The yield records and analyses of the crop during the first year of observation are given in Table VI.

TABLE VI.—Character studies of preliminary selections from Netraconda Estate (Mysore)

Selection No.	Yield ripe cherry in oz.	Calculated yield of clean coffee per acre (1,200 plants) in cwt.	Percentage of triage	Percentage of 'A' grade beans	Percentage of pea-berry.	Weight of 100 'A' grade beans-gms.	Remarks
Net A	49	7.3	15.8	28.6	28.6	21.6	Clean coffee calculated on the basis of actual turn-out from ripe cherry harvested.
" B	307	18.7	12.6	17.5	30.2	19.2	
" C	304	26.1	36.0	42.7	15.7	22.0	
" D	296	30.2	31.3	31.3	13.5	20.5	
" E	82	10.2	14.3	39.3	18.6	20.5	
" F	158	16.0	10.5	46.3	25.9	22.2	

(ii) ROBUSTA

Intraspecific hybrids between promising selections of robusta.—Eight trees recorded below had proved their merit by the regularity of bearing and high average yields varying from 203 oz. per plant against a field average of 61 oz. in the years 1940-41 to 1945-46. These were divided into two groups and four sets of crosses and their reciprocals were effected in 1947. Plants raised from the resulting seed were planted at Chethalli in July 1949.

Details are furnished below.

TABLE VII.—Intraspecific hybrids of robusta.

Crosses	Procedure adopted	Remarks.
1. Crosses A 53-33 × 58-31. Reciprocal a 58-31 × 53-33	Direct and reciprocal crosses planted alternately in the same line.	All the crosses are of fairly good vigour and free from leaf disease. No perceptible difference is noted between direct and reciprocal crosses. The next stage will be to cross A with B and C with D. Later AB with CD to step up production.
2. Crosses B 59-9 × 58-16 Reciprocal b. 58-16 × 59-9	A crosses planted in lines alternating with B.	
3. Crosses C 49-28 × 53-28 Reciprocal c, 53-28 × 49-28	C crosses planted alternating with D.	
4. Crosses D 63-8 × 46-20 Reciprocal d, 46-20 × 63-8	...	

Character studies:—The following table gives the yield records of the latest robusta selections made at Balehonnur.

TABLE VIII.

Selection No.	Yield												oz.				Average in terms of cwt of clean coffee (680 plants per acre).
	of												in				
	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	Average					
1	2	3	4	5	6	7	8	9	10	11	12	13	14				
BR. 1 (267-1/12)	...	12	202	232	172	116	258	163	62	370	208	180	13.7				
Mean of 52 sibs	...	19	64	114	121	62	110	99	126	191	do.	110	102	7.7			
BR. 2 (268-1/7)	..	41	76	544	226	342	144	306	292	502	226	309	283	21.5			
Mean of 52 sibs	...	22	77	143	107	140	140	114	160	198	64	132	118	8.8			
BR. 3 (269-2/6)	...	2	278	128	350	117	380	91	322	374	101	224	215	16.3			
Mean of 52 sibs	...	18	97	120	139	87	135	77	182	261	36	116	115	8.7			
BR. 4 (270-3/12)	...	67	288	168	252	74	183	168	226	310	75	224	185	14.0			
BR. 5 (270-4/9)	..	...	182	328	348	172	308	14	632	642	162	310	282	21.4			
Mean of 52 sibs	..	22	184	144	154	198	128	118	193	244	68	108	142	10.8			

TABLE VIII.—(Continued)

Selection No.	Yield of ripe cherry in oz.											Average in terms of Cwt. of clean coffee (680 plants per acre)		
	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950		Aver- age	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
BR. 6 (272-3/10)	...	58	208	352	77	200	360	166	204	56	46	45	161	12.2
Mean of 52 sibs	...	25	73	83	73	120	90	20	121	176	24	35	76	5.8
BR. 7 (273-1/7)	...	53	16	216	266	246	288	144	302	230	93	100	178	13.5
Mean of 52 sibs	...	14	106	83	72	148	96	49	117	148	18	35	81	6.1
BR. 8 (274-1/6)	...	39	416	72	300	518	158	13	536	433	184	208	263	20.0
BR. 9 (274-1/10)	...	1	400	72	364	200	388	1	394	112	27	278	203	15.4
BR. 10 (274-2/12)	...	1	448	56	354	312	298	226	112	288	92	255	222	16.8
BR. 11 (274-3/13)	...	...	608	2	815	252	148	380	434	614	359	231	349	26.5
Mean of 52 sibs	...	38	203	149	196	177	172	90	265	234	88	86	154	11.7
BR. 12 (275-3/9)	...	5	248	216	203	340	170	132	320	328	48	384	218	16.5
BR. 13 (275-3/7)	...	48	136	328	148	296	110	384	52	296	22	290	192	14.6
Mean of 52 sibs.	...	18	110	151	91	126	100	83	138	229	24	115	108	8.2

7. Practically all the coffee growing areas had their share of seed supply as given in the following table:—

TABLE X. Distribution of seed coffee.

Sl. No.	Area.	Quantity of seeds supplied			
		Arabica.		Robusta.	
		lb.	oz.	lb.	oz.
1	Bababudangiri ...	30	6	3	4
2	Aldur ...	3	1	0	13
3	Belur ...	1	2	1	4
4	Mudigere ...	12	4	2	13
5	Saklaspur ...	12	5	5	15
6	Balehonnur-Koppa ...	43	15½	7	1
7	Biligiris ...	6	8	—	—
8	Coorg ...	27	13	13	4
9	Malabar & Wynaad ...	18	8	4	15
10	Cochin ...	8	8	2	0
11	Travancore ...	1	4	—	—
12	Nilgiris ...	16	2	—	—
13	Coimbatore ...	1	2	—	—
14	Anamalais ...	4	4	2	0
15	Shevaroys ...	9	6	2	0
16	Vizagapatam ...	4	4	2	0
17	Porbandur ...	0	4	0	4
18	Madhya-pradesh ...	0	3	—	—
Total ...		201	3½	47	9

8. **Regional nurseries.** The 13 Regional nurseries started during the previous year continued to function. One additional nursery was opened during the year in Wynaad at Kottaram Estate, Kalpatta P.O. There was a keen demand for seedlings from these nurseries and several coffee growers in the neighbourhood have benefitted by this scheme. Table XI gives the quantities of seeds supplied to Regional nurseries and the number of seedlings raised in them.—

B. *Vegetative Propagation:*

9. The propagation of clonal material by the rooting of arabica and robusta sucker cuttings proceeded apace throughout the year. It was found that the unusual post-monsoon drought conditions adversely affected the rooting of cuttings planted in open sand beds, but this effect was less marked in propagation chambers. For the first time, rooted sucker cuttings were utilized on a large scale for filling up vacancies in non-experimental plots. A study of the root system of 18-month old plants raised from sucker cuttings revealed that one and occasionally two of the roots assumed the role of tap roots and grew straight down to the soil giving good anchorage to the plant. Clonal material from selected plants have been planted out on a field scale for further multiplication and production of a larger number of clonal plants required for a comprehensive manurial experiment which is to be laid out shortly. From the experience gained so far it is found that single noded leafy sucker cuttings constitute the best material for vegetative propagation.

10. An experiment was conducted to study the effect of various dilutions of Seradix A on single noded leafy sucker cuttings. Two sets were planted, the first in open beds at the end of July 1949 and the second in propagation chambers at the beginning of September. The results which are furnished below point to the need of propagation chambers to protect the cuttings against adverse weather conditions during the post-monsoon period. At the same time it shows that this hormone preparation does not impart any marked benefit to the cuttings. Table XII (a) and XII (b).

TABLE XI. Seeds supplied to regional nurseries and seedlings raised therein as at the end of the year.

Regional Nurseries.	Arabica Selections						S. 274 robusta.	Total
	288	645	795	838	S. 26 X Kent	S. 531 X Kent		
1	2	3	4	5	6	7	8	9
<i>Mysore</i>								
Galikere, Attigundi P.O.								
Seeds supplied-oz.								
Seedlings raised								400
<i>Coorg</i>								
Nullore Group, Sunkoppa								
Seeds supplied-oz.	16	12	16	...	8	16	32	100
Seedlings raised	1009	1091	1081	12	400	987	2460	7040
Madapur, Madapur P.O.								
Seeds supplied-oz.	16	12	16	...	8	16	32	100
Seedlings raised.		90	12	15				117
<i>Malabar-Wynaad</i>								
Kottaram, Kalpatta P.O.								
Seeds supplied-oz.	16	12	16	...	8	16	32	100
Seedlings raised								...
<i>Cochin</i>								
Govt. Fruit & Veg. Farm, Sitharkunda P.O.								
Seeds supplied-oz.	16	12	16	...	8	16	32	100
Seedlings raised.								2400
<i>Nilgiri-Wynaad</i>								
Glenvans, New Hope P.O.								
Seeds supplied-oz.	16	12	16	...	8	16	...	68
Seedlings raised.								4500
<i>Nilgiris</i>								
Adderly, Coonoor P.O.								
Seeds supplied-oz.	16	12	16	...	8	16	...	68
Seedlings raised.	...	370	45	...	110	...	...	525
<i>Coimbatore</i>								
Honnametti, Attikan P.O.								
Seeds supplied-oz.	16	12	16	...	8	16	...	68
Seedlings raised.	...	302	121	134	...	...	...	557
<i>Anamalais</i>								
Waterfall, Attakatti P.O.								
Seeds supplied-oz.	16	12	16	...	8	16	32	100
Seedlings raised	...	200	90	15	...	...	...	305
<i>Shevaroy</i>								
Hawthorne, Yercaud P.O.								
Seeds supplied-oz.	16	12	16	...	8	16	32	100
Seedlings raised.	200	284	79	32	...	...	2300	2895

TABLE XII (a). Effect of synthetic hormones on single-noded leafy cuttings of arabica during monsoon.

Locality: Balehonnur (Mysore) | Medium: Sand beds (in the open)
 Date of planting: 30-7-49 | Date of observation: 10-12-49.

	Control	Drops of Seradix A added per pint of water					
		3	6	12	24	48	96
No. of cuttings planted	150	150	150	150	150	150	150
Percentage of cuttings rooted	15.3	10.0	28.7	30.0	20.7	14.7	20.0

TABLE XII (b). Effect of synthetic hormones on single-noded leafy cuttings of arabica.

Locality : Balehonnur (Mysore). Medium : Sand beds (In propagation chambers)
 Date of Planting : 10-9-49 Date of observation : 8-6-50.

	Control	Drops of Seradix A added per pint of water					
		3	6	12	24	48	96
No. of cuttings planted ..	150	150	150	150	150	150	150
Percentage of cuttings rooted ...	57.3	62.0	49.3	32.7	52.0	42.0	66.0

11. **The effect of coating sucker cuttings with paraffin.** Based on the experience with some crops like sugar-cane, an experiment was laid to study the effect of protecting the exposed surface of sucker cuttings with a thin coat of paraffin wax ; but the results were not encouraging.

II. CHEMISTRY

12. **Manurial Experiments.** The permanent manurial experiments at Balehonnur and the co-operative manurial experiments in various private estates started in 1939 were continued. An important departure made during the period was the increase in the dose of nitrogen from 20 lb, to 40 lb. per acre without any alterations in the dosages of potash and phosphoric acid. Thus the new formula is 40-30-40. But the application of the manures was carried out either while the crop was nearing harvest or after the 1950 harvest so that the increased dose of nitrogen had no chance to become felt in the 1949-50 harvest.

TABLE XIII.—Yield records of Permanent Manurials, Coffee Research Station, (Balehonnur.)

Annual rate of manuring :

N (From 1941 to 1949—) = 20 lb. per acre.

Do (From 1950 . . .) = 40 lb. do.

P₂O₅ = 30 lb. do.

K₂O = 40 lb. do.

Area of experimental block : 76 cents. Layout : Latin square.

No. of plants per sub-plot : 5 x 8. Spacing ; 5 ft. x 5 ft.

Variety : Kent's arabica. Guard-rows : One row all around the block.

TABLE XIII.—Yield Records of permanent manurials

YEAR	Average calculated yield of ripe cherry in lb. and clean coffee in cwt. per acre.					Signi- ficant or not	Std. error expressed as % of general mean	Critical difference P = 0.05	Conclu- sions	
	TREATMENTS									
	N A	N+P B	N+K C	+K D	Con- trol E					
1941	...	791	663	918	918	553	No	21.8	513	C,D,A,B,E
1942	...	1250	1207	1335	1360	740	Yes	11.8	436	D,C,A,B,E
1943	...	60	89	113	85	43	Yes	17.9	16	C,B,D,A,E
1944	...	255	213	306	264	204	No	19.0	147	C,D,A,B,E
1945	...	1155	1132	1519	1744	736	No	26.9	1040	D,C,A,B,E
1946	...	400	531	332	595	510	No	27.4	411	D,B,E,A,C
1947	...	468	697	714	697	587	No	4.9	379	C,D,B,E,A
1948	...	281	306	306	255	272	No	17.1	498	B,C,A,E,D
1949	...	489	655	483	761	674	Yes	8.2	107	D,E,B,A,C
1949 (clean coffee)	0.625	0.83	0.688	0.83	0.964		No	1.2	0.294	E,D,B,C,A
1950	...	1776	1836	1700	1734	1598	No	9.4	455	B,A,D,C,E
1950 (clean coffee)	4.36	4.66	4.23	4.52	4.00		No	10.41	1.4	B,D,A,C,E
Average for 10 years	...	704	743	787	858	598	Yes	9.92	206	D,C,B,A,E

Taking the yield figures of cherry and clean coffee for 1950, the treatments have not shown any significant results. However, the analysis of the average yields for 10 years continue to show that 'complete manure' is significantly superior to no manure', but not superior to other manurial treatments, viz. N, N+P and N+K. It is too early to state whether the doubling of the dose of N from 20 to 40 lb. would produce any significant results in future crops.

Co-operative Manurial Experiments on private estates

13. In this series of experiments also, the dose of nitrogen has been increased from 20 to 40 lb. But the application of manure was done in November 1949 so that it is too early, to expect any results from the change. The results obtained during a period of 11 years are presented below:—

Annual rate of manuring

N (1940 to 1948)	=	20 lb. per acre.
De. (From 1949 Nov.)	=	40 lb. do
P ₂ O ₅	=	30 lb. per acre.
K ₂ O	=	40 lb. do.

Series I.

Area of Experimental Plot: 1.43 cents.
Layout: Latin square 5 × 5
Variety: Kent's arabica.
Spacing: 6' x 6'

Shade: Natural shade.
No. of plants per sub-plot:
Gross 10 × 7
Nett 8 × 5

TABLE XIV—Results of co-operative manurial experiments.

Experiment I.—Santaweri Estate (Mysore)

YEAR	Average calculated yield of ripe cherry in lb. per acre.					Signifi- cant or not	Standard error expressed as % of gen. mean	Critical difference P=0.05	Conclu- sions.
	TREATMENTS								
	N A	N+P B	N+K C	N+P +K D	Con trol E				
1940	... 1290	1440	1902	1110	2376	No	17.65	1170	<u>E,C,B,A,D</u>
1941	.. 1260	1371	1908	1128	2286	Yes	13.04	639	<u>E,C,B,A,D</u>
1942	... 2166	2196	1794	1812	2658	Yes	12.78	839	<u>E,B,A,D,C</u>
1943	... 2352	2616	2664	2538	2580	No	9.79	769	<u>C,B,E,D,A</u>
1944	... 678	522	612	452	732	No	14.20	264	<u>E,A,C,B,D</u>
1945	... 2466	3348	2778	2941	2904	Yes	8.59	766	<u>B,D,E,C,A</u>
1946	... 3318	3432	3210	2418	2712	Yes	8.12	755	<u>B,A,C,E,D</u>
1947	... 2352	2460	2484	2520	2628	No	13.73	1106	<u>E,D,C,B,A</u>
1948	... 3702	4194	3420	3000	3636	No	17.64	1956	<u>B,A,E,C,D</u>
1949	... 714	732	738	492	720	No	16.25	341	<u>C,B,E,A,D</u>
1950	... 3702	3468	3666	4236	3330	Yes	7.13	808	<u>D,A,C,B,E</u>
Average for 11 years	... 2182	2344	2289	2060	2415	Yes	3.84	266	<u>E,B,C,A,D</u>

For the first time in 11 years, the 'complete manure' has given significantly better yields than 'no manure', but there is no significant difference between D (complete manure) and B (N+P). Similarly there is no significant difference among E (control), A (N) and C (N+K). The analysis of the average yields for 11 years shows no significant response to manuring. As in the other experiments, the effect of the increased dose of N may become felt only in subsequent harvests.

TABLE XV.—Experiment 2. Watekhan Estate (Mysore)

YEAR	Average calculated yield or ripe cherry in lb. per acre					Signifi- cant or not	Standard error ex- pressed as % of gen. mean	Critical differ- ence P=0.05	Conclusions
	TREATMENTS								
	N A	N+P B	N+K C	N+P +K D	CON- TROL E				
1940	1686	1476	1620	1662	1428	No	11.14	541	<u>A,D,C,B,E</u>
1941	Results					not recorded			
1942	930	708	978	672	696	No	13.5	333	<u>C,A,B,E,D</u>
1943	960	1422	1050	834	1116	No	12.17	553	<u>B,E,C,A,D</u>
1944	2244	1884	2352	2892	1950	Yes	10.79	750	<u>D,C,A,E,B</u>
1945	2406	2308	2688	2874	3618	Yes	12.41	1148	<u>E,D,B,C,A</u>
1946	3204	2988	3864	3648	2700	Yes	6.87	817	<u>C,D,A,B,E</u>
1947	4158	4224	3966	4014	4842	No	13.5	1637	<u>E,B,A,D,C</u>
1948	1710	960	866	936	936	No	11.14	933	<u>A,B,D,E,C</u>
1949	3936	4164	3858	4185	3516	No	8.6	1046	<u>D,B,A,C,E</u>
1950	1218	1272	1248	1290	1260	No	9.05	347	<u>D,B,E,C,A</u>
Average for 10 years	2245	2191	2249	2301	2206	No	5.93	513	<u>D,C,A,E,B</u>

In this experiment, the treatments have failed to produce any significant increase over the 'control' except in 1944 when the 'complete manure' was better than the rest. The average yields of 10 years do not show any significant difference. The 'complete manure' has however shown numerical superiority over other treatments during the last two years and in the averages of 10 years. As in the previous experiments, the results of increased dose of N may become felt only in future harvests.

TABLE XVI.—Experiment 3. Kirgandur Estate (Coorg)

YEAR	Average calculated yield of ripe cherry in lb. per acre					Signi- ficant or not	Critical differ- ence P=0.05	CONCLU- SIONS	
	TREATMENTS								
	N A	N+P B	N+K C	N+P +K D	Cont- rol E				
1940	...	1362	1320	1242	1062	1362	No	416	<u>E, A, B, C, D</u>
1941	...	2562	2106	2286	2796	2124	No	1262	<u>E, A, C, E, B</u>
1942	...	1088	1020	1338	1008	846	Yes	430	<u>C, A, B, D, E</u>
1943	...	1358	1818	1566	1608	1542	No	528	<u>B, D, C, E, A</u>
1944	...	5076	5724	5712	4056	4860	No	1286	<u>B, C, A, E, D</u>
1945	...	4914	3948	3900	4188	3906	Yes	992	<u>A, D, B, E, C</u>
1946	...	3595	3912	4189	3269	3707	No	852	<u>C, B, E, A, D</u>
1947	...	3408	3132	4080	4672	3366	No	912	<u>C, D, A, E, B</u>
1948	...	366	606	330	276	300	Yes	242	<u>B, A, C, E, D</u>
1949	...	4464	4650	3862	4386	4260	No	922	<u>B, A, D, E, C</u>
1950	...	3306	3292	3233	3455	3364	No	1395	<u>D, E, A, B, C</u>
Average for 11 years	...	2865	2866	2885	2798	2694			

There is no response to manuring in 8 out of 11 years. Taking the average yields into consideration, the 'control' continues to be lowest numerically, but does not fall within the level of significance.

TABLE XVII.—Experiment 4. Gargandur Estate (Coorg)

YEAR	Calculated yield of ripe cherry in lb. per acre						Signifi- cant or not	Critical differ- ence	Conclusions
	TREATMENTS								
	N A	N+P B	N+K C	N+P +K D	CON- TROL E				
1940	...	979	937	1047	1211	709	Yes	407	<u>D,C,A,B,E</u>
1941	...	1924	1802	2103	2572	2700	No	929	<u>E,D,C,A,B</u>
1942	...	2132	1792	2338	2669	1707	No	1086	<u>D,A,C,B,E</u>
1943	...	1291	401	564	378	899	No	735	<u>A,E,C,B,D</u>
1944	...	2814	3492	4200	4248	3294	No	1092	<u>D,C,B,E,A</u>
1945	...	2148	1494	1956	1428	2070	No	920	<u>A,E,C,B,D</u>
1946	...	2279	2345	3279	2571	2474	No	1010	<u>C,D,E,B,A</u>
1947	...	2742	2580	3120	2724	2970	No	468	<u>C,E,A,D,B</u>
1948	...	126	90	78	54	72	No	83	<u>A,B,C,E,D</u>
1949	...	3174	3204	3112	3264	3252	No	608	<u>D,E,B,A,C</u>
1950	...	1632	2082	1777	1962	2073	No	479	<u>B,E,D,C,A</u>
Average for 11 years	...	1931	1838	2143	2098	2020			

In this experiment also there is no response to manure except in 1940 when D was superior to E. The 11 year averages do not show any significant difference between the manurial treatments.

Series II

14. **Bulky v. concentrated manures.** The results of another series of experiments started in 1939 to study the relative merits of bulky and concentrated manures are as follows:—

Locality: Netraconda (Mysore).

Annual rate of manuring:—
 N = 20 lb. per acre
 P₂O₅ = 30 " " "
 K₂O = 40 " " "

Area of Exptl. plot: 1.83 acre.

Layout: Latin square 4 × 4

Variety: Kent's arabica.

No. of plants per sub-plot:—

Shade: Natural Shade.

Gross: 13 × 11, Nett: 11 × 9
Spacing: 6 ft. × 6 ft

Treatments :

(A) ($\frac{1}{2}$ bulky + $\frac{1}{2}$ concentrated nitrogen)—Compost to provide 10 lb. nitrogen and the balance of 10 lb. nitrogen as a mixture of groundnut oil-cake and ammonium sulphate *plus* enough superphosphate *plus* sulphate and muriate of potash (in equal quantities) to provide 30 lb. P_2O_5 and 40 lb. K_2O respectively.

(B) (Bulky nitrogen)—Compost to provide 20 lb. nitrogen *plus* sufficient superphosphate *plus* sulphate and muriate of potash (in equal quantities) to provide 30 lb. P_2O_5 and 40 lb. K_2O .

(C) (Concentrated Nitrogen)—15 lb. nitrogen as groundnut oil-cake and 5 lb. of nitrogen as ammonium sulphate *plus* superphosphate *plus* sulphate and muriate of potash (in equal quantities) to provide 30 lb. P_2O_5 and 40 lb. K_2O .

(D) Control—(No manure).

**TABLE XVIII.—Results of bulky v. concentrated manures,
Netraconda Estate (Mysore)**

YEAR	Average yield of ripe cherry in lb. and clean coffee in cwt. per acre				Signi- ficant or not	Stand- ard er- ror ex- pressed as % of gen. mean	Critical differ- ence P=0.05	Conclusions
	TREATMENTS							
	A	B	C	D				
1940, Cherry	424	596	549	502	No	18.45	394	B, C, D, A
1941 "	900	882	824	888	No	38.33	579	A, D, B, C
1942 "	748	743	867	703	No	28.69	763	C, A, B, D
1943 "	112	111	115	173	No	40.54	183	D, C, A, B
1944 "	515	636	712	667	No	17.73	403	C, D, B, A
1945 "	1140	1206	1335	1381	No	10.74	1484	D, C, B, A
1946 "	1967	1624	1254	1318	No	15.56	932	A, B, D, C
1947 "	909	1041	1123	902	No	9.63	332	C, B, A, D
1948 "	152	224	127	143	No	15.11	86	B, A, D, C
1949 "	1830	1767	1879	1860	No	10.31	447	C, D, A, B
" Clean coffee	2.54	2.71	2.84	3.00	No	8.99	1.14	D, C, B, A
1950, (Ripe cherry)	1212	1169	1206	1163	No	15.98	655	A, C, B, D
" Clean coffee	1.9	1.78	1.84	1.76	No	30.53	0.938	A, C, B, D
Average for 11 years	910	909	908	887	No	9.23	280	A, B, C, D

The treatments have not shown significance either in individual years or in the average yields over 11 years. This confirms the comment made in the previous report that the addition of 20 lb. of N either applied in bulk or concentrated form does not produce any response under the conditions or coffee cultivation under shade. Elsewhere in this report it has been estimated that the quantity of mulch of dry leaves provided by the shade trees amounts from 2.5 to 4.1 tons per acre per year.

TABLE XIX.—Results of manurial experiments, Buthanhadloo (Coorg)
Annual rate of manuring :

(A) No manure (Control).

(B) Cattle manure 5 tons per acre.

(C) Cattle manure 5 tons *plus* 30 lb. of N in the form of groundnut cake and 40 lb. P_2O as bonemeal.

(D) Cattle manure 5 tons *plus* 30 lb. N as groundnut cake, P_2O_5 as steamed bonemeal and 50 lb. K_2O as muriate of potash.

(E) 30 lb. N as groundnut cake *plus* 40 lb. $P O_5$ as steamed bonemeal and 50 lb. K_2O as muriate of potash.

Area of Exptl. block: 1.28 acres. Spacing: 6 ft. x 6 ft.

Variety: Kent's arabica. No. of plants per sub-plot:

Shade: Natural shade.

Gross — 8 x 8;

Layout: Latin square 5 x 5. Nett — 6 x 6

YEAR	Yield of ripe cherry in lb. per acre					Sig. or not	Std. error	Critic- al diff.	Conclusions
	A	B	C	D	E				
1943	1881	1782	1584	1584	1485	No	365	1124	A, B, C, D, E
1944	1534	1221	1518	1584	1881	No	315	870	E, A, D, C, B
1945	4138	4112	3653	3854	3346	No	316	974	A, B, D, C, E
1946	318	251	86	185	185	Yes	75	231	A, B, E, D, C
1947	1749	1439	1432	1228	1016	No	192	593	A, B, C, D, E
1948	2970	3399	2574	2831	2780	No	291	898	B, A, D, E, C
1950	2733	2767	2533	3100	2533	No			C, A, E, B, D
Clean coffee in cwt: 1950	4.89	4.94	4.7	5.54	4.53				
Average for 7 years	2196	2134	1927	2049	1889				

This experiment was started in 1943 and continued till 1947, suspended for one year, but revived in 1949. There is no response to manuring either in individual years or in the averages for a 7 year period. The 30-40-50 mixture has given numerically the lowest averages suggesting that potash exercises a depressing effect on yields.

15. Lights in relation to manurial treatments: During the 1949 and 1950 harvests, the float contents of the produce were determined both by weight and volume in the permanent manurials at Balehonnur, and the co-operative manurial series conducted in Mysore. In the permanent manurials (Table XIII), and Bulky *v.* Concentrated (Table XVIII), the treatments have not shown significant differences in the percentages of 'floats' either by weight or volume. In other experiments, the results have been conflicting.

16. Catalyzation of plant nutrients: Two experiments were laid one at each research station in collaboration with the Biochemist, Indian Institute of Science, Bangalore to study the effect of small doses of iron and manganese salts in improving the availability of plant-foods. The results are furnished below:—

EXPERIMENT I

Locality : L-1 block of the Coffee Research Station, Balehonnur.

Annual rate of manuring : (a) N 20 lb. per acre
 15 lb. as g.n. oil-cake.
 5 lb. as ammonium sulphate
 (b) P_2O_5 30 lb. per acre as superphosphate
 or steamed bone meal.
 (c) K_2O 40 lb. per acre as cherry husk ash.

In addition certain catalysts (certain chemicals in very fine state of sub-division) are added to the subplots according to treatment.

Area of Expt. plot : 1.43 acres. *Layout* : Latin square 5×5
Variety : Kent's arabica No. of plants per sub-plot
Shade : Natural shade Gross 10×7 , Nett 8×5
Spacing : 6 ft. $\times$ 6 ft

Treatments : General manurial mixture containing 20 lb. N, 30 lb. P_2O_5 and 40 lb. K_2O (per acre of 1,200 plants) to all the sub-plots :—

A — Proprietary Product A.
 B — Proprietary Product B.
 C — Ferrous sulphate.
 D — Potassium permanganate.
 E — Control (No catalyst added).

TABLE XX.—Results of catalyzed manures experiment

YEAR	Average yields of ripe cherry in lb. and clean coffee in cwt. per acre.					Signifi- cant or not	Standard error expressed as % of gen. mean	Critical difference P=0.05	Conclu- sions.
	TREATMENTS								
	A	B	C	D	E				
1949									
Ripe cherry...	498	504	456	480	480	No	49.1	74	<u>B,A,D,E,C</u>
Clean coffee...	0.813	0.893	0.508	0.732	0.758	No	18.05	0.41	<u>B,A,E,D,C</u>
1950									
Ripe cherry...	672	624	498	798	558	No	19.21	374	<u>D,A,B,E,C</u>
Clean coffee...	0.929	0.804	0.696	1.00	0.732	No	20.93	0.545	<u>D,A,B,E,C</u>

The results have not been significant. Ferrous sulphate appears to have depressed the yields. It is now proposed to raise the dose of nitrogen from 20 to 40 lb. per acre in conformity with other manurial experiments.

EXPERIMENT II

Locality : Coffee Research Station, Chethalli.
Variants : Five as noted in the table.
Layout : 5×5 latin square.
Area of sub-plot : Gross 10×7 plants, Nett 8×5 plants.
Variety : Arabica (Coorgs) planted about 20 years back.
Shade : Natural shade.

TABLE XXI.—Results of catalyzed manures experiment

No.	Symbol	Treatments	Ripe cherry in lb. per acre	Clean coffee in cwt. per acre
1	2	3	4	5
1.	<i>A</i>	28 lb. ferrous sulphate per acre.	1685	3.0
2.	<i>B</i>	20 lb. potassium permanganate.	1330	2.38
3.	<i>C</i>	40 lb. catalyst product.	1436	2.56
4.	<i>D</i>	80 lb. catalyst product.	744	1.33
5.	<i>E</i>	Control—No catalyst.	1538	2.75
Mean.			1347	2.4
Significance by Z test. ($P=0.05$).			No.	The error is very high, hence the experiment requires repetition.
Critical difference in lb. per acre.			1231	
S.E.M. %			29.50	
Conclusions.			<i>A, E, C, B, D</i>	

There is no significant difference between the treatments. The highest dose of catalyst product has depressed the yields perceptibly, but it misses significance.

17. Fundamental manurial trials at Balehonnur: Implementing one of the recommendations of the Expert Committee, a fundamental experiment on manuring was started at Balehonnur using 36 uniform-sized concrete cisterns originally erected for pH studies. Rooted cuttings of *S. 31* were planted in these cisterns in 1949. The manurial applications, details of which are furnished below, were made in May 1950:—

EXPERIMENT

Locality: Coffee Research Station, Balehonnur.
Variety: Arabica (clones from *S. 31*).
Treatments: 6. Size of each cisterns: $6' \times 6' = 36$ sq. ft.
Replications: 6. Area of exptl plot: 3 cents.
Unit: Single plant. *Layout:* Latin square 6×6 .
Shade: Artificial (coir netting).

Treatments		Pounds per acre.		
		N.	P_2O_5	K_2O
1.	...	20	30	40
2.	...	30	30	40
3.	...	45	30	40
4.	...	30	45	40
5.	...	30	45	60
6.	...	45	67.5	90

Nitrogen is given half as groundnut oil-cake and half as ammonium sulphate. Half the nitrogen is to be applied pre-monsoon and half post-monsoon. Phosphoric acid and potash is given pre-monsoon mixed with the nitrogenous manure and applied in the form of a broad band around the plants. The pH of the soil from the cisterns was determined before the application of the manures and found to be more or less uniform around pH 7. Samples of soil are drawn periodically in order to assess the changes which the manures undergo and the response of the plants to the manurial applications.

18. The influence of potash on bean quality and yield:

This experiment was started at Chethalli sub-station in 1948. The first application of manures was made in April 1948. The results are furnished below:—

Locality: Coffee Research sub-station, Chethalli.
Variants: 4. *Layout:* 4 x 4 Latin square.
Variety: Arabica (Coorg) Area of each plot — 6 x 3 plants,
 about 20 yrs. old. 1½ cents
Shade: Natural shade.

TABLE XXII.

No.	Symbol	Treatments	Yield per acre		per cent of floats per treatment (Volume)
			Ripe cherry in lb.	Clean coffee in cwt.	
1	A	40 lb. K ₂ O	2484	4.44	2.95
2	B	60 lb. K ₂ O	2163	3.87	2.77
3	C	90 lb. K ₂ O	1907	3.4	2.23
4	D	Control-No potash. Only 40 N + 30 P ₂ O ₅	2767	4.94	2.40
		Mean:—	2330	4.16	2.56
		Significance by Z test (P=O, 05)	No		No.
		Critical difference in lb. per acre.	1023		1.39
		S.E. Mean %	12.93		15.70
		Conclusions	D,A,B,C		A,B,D,C

The results show no significant difference between treatments. The yield figures however suggest a gradual depressing effect with the increase in the dose of potash. In float content on the other hand, the highest dose of potash shows numerically the least float content, but the difference is not significant. The experiment is continued.

19. Laboratory Work: The work in the laboratory consisted mainly of routine analysis of coffee soil samples either received from planters or collected by the departmental staff. Soil samples collected between 1947 and 1950 from the permanent manurial plots at Balehonnur were analysed for their pH and total nitrogen contents. The analysis of phosphate and potash is being done. The summarised results of nitrogen analyses of soil samples collected in 1947, 1949 and 1950 are recorded below along-side the original nitrogen contents of the plots estimated in 1937.

TABLE XXIII.—Nitrogen analyses of Permanent Manurial plots

Treatment	Depth of sample	Total nitrogen % on air-dry samples.			
		1937	1947	1949	1950
N only	0—9"	0.1746	0.2145	0.1872	0.2462
	9"—18"	0.1644	0.1875	0.1582	0.2022
N + P	0—9 "	0.1712	0.2122	0.1768	0.2312
	9"—18"	0.1534	0.1858	0.1624	0.2148
N + K	0—9"	0.1582	0.2192	0.1852	0.2548
	9"—18"	0.1652	0.1946	0.1608	0.1960
N + P + K	0—9"	0.1793	0.2272	0.1910	0.2388
	9"—18"	0.171	0.2014	0.1722	0.1928
Control	0—9"	0.1746	0.2172	0.1676	0.2492
	9"—18"	0.1600	0.1894	0.1694	0.1950

It will be seen from the table that as a rule the top 9 inches of soil shows a higher nitrogen content than the second 9 inches. There has been a conspicuous increase in the total nitrogen content in 1947 and 1950. Another feature is that the control plots which received nothing beyond the leaf mulch applied alike to all plots show no significant difference in nitrogen values from the four sets of plots which received nitrogen yearly at

20 lb. per acre. This suggests that the leaf mulch applied at the rate of 10,000 lb. per acre swamps the influence of manurial applications as far as nitrogen is concerned.

20. About 200 samples of soils representative of important coffee tracts of S. India were analysed for their N P K content, pH, moisture and loss on ignition. It was found that the N P K status of the coffee soils of S. India, with but few exceptions, is satisfactory. The exchangeable lime, P_2O_5 and K_2O contents of these soils are being studied and may give a clue to the causes of variations in yield on soils of apparently equal fertility status.

21. An attempt was made to assess the manurial value of the leaves falling from various species of shade trees in a coffee estate. The following is the analysis of the leaves of 9 species of shade grown at Balehonnur.

TABLE XXIV.—Analysis of shade tree leaves

Shade tree	% on air-dry basis				% on oven-dry basis				
	Mois- ture	Loss on ig- nition	Ash	Inso- luble residue	N	K_2O	P_2O_5	Organic Carbon	C/N
<i>Erythrina lithosperma</i> ...	7.75	82.50	3.50	6.40	2.245	1.188	0.234	43.91	19.56
<i>Bischofia javanica</i> ...	11.00	80.60	8.40	2.64	1.141	2.212	0.229	40.74	35.71
<i>Terminalia bellerica</i> ...	8.80	80.30	10.90	2.82	1.623	0.783	0.245	40.88	25.19
<i>Ficus tsiela</i> ...	11.10	73.80	15.10	3.96	1.209	0.722	0.342	40.57	33.57
<i>Ficus retusa</i> ...	6.36	83.60	9.24	1.76	0.819	0.494	0.144	40.95	50.01
<i>Albizzia lebbek</i> ...	7.36	67.36	25.28	16.60	1.965	0.532	0.242	27.95	14.22
<i>Grevillea robusta</i> ...	7.53	84.40	8.07	23.80	1.184	0.561	0.128	39.3	33.2
<i>Artocarpus integrifolia</i> ...	9.26	67.52	23.22	15.93	1.175	0.739	0.128	34.67	29.5
<i>Eugenia jambolana</i> ...	9.58	86.10	4.32	0.32	0.804	0.752	0.139	41.08	54.6

It will be seen from the above table that for the same dry weight, the leaves of dadap (*Erythrina lithosperma*) and *Albizzia lebbek* which are both leguminous plants contain more nitrogen than the non-leguminous species. The carbon/nitrogen ratio of dadap is higher than that of *A. lebbek*. The deciding factor should however be the quantity of leaf on a dry basis that is shed by each species. It is proposed to estimate periodically the quantities of leaf that are shed by important species of shade trees.

22. **Fixation of phosphates and retention of ammonia by coffee soils:** Based on the recommendations of the Expert Committee a fundamental study was started to determine the progressive quantities of phosphate fixed and ammoniacal nitrogen retained by coffee soils. The results obtained so far are tabulated below.

TABLE XXV.—Quantity of ammoniacal nitrogen retained by 50 gms of soil

Days	Ammonium sulphate gms	Ammonium nitrate gms.	Days	Ammonium phosphate gms.
2	0.0280	0.0192	4	0.0620
4	0.0208	0.0269	6	0.0611
7	0.0203	0.0216	8	0.0674
10	0.0301	0.0236	11	0.0700
13	0.0301	0.0278	14	0.0741
15	0.0340	0.0221	18	0.0747

TABLE XXVI.—Quantity of phosphate fixed by 50 gms. of soil

Days.			Quantity of P_2O_5 fixed.
4.	...	...	0.345 gms.
6.	...	...	0.394 "
8.	...	...	0.402 "
11.	...	...	0.435 "
14.	...	...	0.452 "
18.	...	...	0.454 "

These results show that the quantities of ammoniacal nitrogen retained depends largely on the composition of the source of ammonia applied. In the case of phosphates, it is found that all the available P_2O_5 is fixed within a fortnight of the application of the fertilizer. Further work is in progress.

III. AGRONOMY

23. The following were the agronomic investigations conducted during the year under report :—

1. Study of the influence of pruning on yields.
2. Effect of pruning in relation to spraying.
3. The incidence of 'floats' (light cherry) in relation to spraying and pruning.
4. The effect of spraying and pruning on bean quality.
5. The effect of different methods of shading as practised by coffee growers in young clearings.
6. The relative merits of bed plants and basket plants.
7. The effect of time of transplanting seedlings from germination beds to plant baskets.
8. The study of basic yields for standardisation of experimental plots.
9. The behaviour of green manures sown under established coffee.
10. Rejuvenation experiments on old coffee.
11. The effect of early and late pitting for planting in new clearings.
12. The determination of the quantity of organic matter added to coffee soils under light and heavy shade.
13. Single stem *v.* multiple stem.
14. The use of plant hormones for preventing fruit-drop.
15. The effect of weed-killers.
16. Seed germination tests.

24. **The effect of pruning on yields:** The results of experiments started in 1946 are furnished below :—

Locality: Ghattedhulla (Coorg). *Layout:* Latin square 5×5
Area of Exptl. plot: 2.71 acres. *Area of each sub-plot:* Nett 10×10 ,
or 100 plants (1/12 acre).
Variety: Arabica (Coorgs).
Shade: Natural shade.
Variants: 5.

Treatments:

- A* — Light hot weather prune.
B — Light monsoon prune.
C — Medium hot weather prune.
D — Medium monsoon prune.
E — Control—no prune.

TABLE XXVII.—Effect of pruning on yields: pruning

TREATMENTS	LEAF COUNTS					YIELD PER ACRE							
	Sep. 46	Sep. 47	Feb. 46	Feb. 47	Feb. 48	Feb. 50	Ripe	cherry	in lb.	Calculated clean	coffee in cwt.		
							1946	1947	1948	1946	1947	1948	1950
A	49.7	25.8	24.0	13.2	23.1	18.2	1345	2706	1754	1834	4.03	2.61	2.73
B	44.2	23.7	28.6	13.1	23.6	22.0	1224	2530	1782	1889	3.76	2.65	2.81
C	38.1	25.8	23.9	15.4	24.5	24.9	1020	3196	1686	1812	4.76	2.51	2.70
D	50.8	29.4	32.4	14.2	23.0	23.5	938	2652	2176	1915	3.95	3.24	2.85
E	47.4	25.3	25.2	13.2	22.6	18.3	1510	2708	2285	1509	4.03	3.40	2.25
Gen. mean	46.0	26.0	26.8	13.8	23.4	21.4	1208	2758	1937	1759	4.10	2.88	2.62
Sig. or not	Yes	No	Yes	Yes	No	No	Yes	No	No	No			
Std. error	9.37	10.94	10.34	4.96	3.95	9.39	10.70	12.11	20.30	18.47			
Crit. Diff.	12.6	8.3	8.1	2.0	2.7	6.2	378	975	1164	932			
Conclusions	DAEBC	DACEB	DBEAC	CDABE	CBABE	CDBEA	EABCD	CAEDB	CBABE	DBCAE	1.45	1.73	1.39

It is found that there are no significant difference except in one year among the four methods of pruning, but none of them happens to be superior to control (no pruning).

31. Effect of pruning in relation to spraying:

Treatments: A — Spraying alone (pre- and post-monsoon treatments).

B — Pruning.

C — Spraying plus pruning.

D — Control.

Locality:

Area of exptl. Block: Balehonnur.

Variety: 2.05 acres.

Variables: Coorgs.

Replications: 4.

Shade: Natural shade.

Layout: Factorial design 2 × 2.

Outskirt: One row all round.

Spacing: 6 ft. × 6 ft.

No. of plants per sub-plot:

Gross 20 × 8, Nett 18 × 6.

TABLE XXVIII.—Results of pruning and sprays

Year	Calculated yield of ripe cherry in lb. & clean coffee in cwt. per acre				Signi- ficant or not	Std. error expre- ssed as % of gen. mean	Critic- al diffe- rence P = 0. 05	Conclusions
	Spray A	Prune B	Spray + prune C	Control D				
1940 Cherry ...	2575	2450	2175	2400	No	14.45	113	<u>A,B,D,C</u>
1941 „ ...	2400	1450	1600	1425	Yes	31.99	587	<u>A,C,B,D</u>
1942 „ ...	800	100	1110	75	Yes	49.63	824	<u>C,A,B,D</u>
1943 „ ...	700	450	350	750	Yes	3.97	207	<u>D,A,B,C</u>
1944 „ ...	791	225	705	192	Yes	29.73	457	<u>A,C,B,D</u>
1945 „ ...	3646	513	3287	536	Yes	13.39	558	<u>A,C,B,D</u>
1946 „ ...	192	619	142	694	Yes	15.46	204	<u>D,B,A,C</u>
1947 „ ...	747	78	433	150	Yes	20.15	229	<u>A,C,D,B</u>
1948 „ ...	2530	1050	2455	988	Yes	8.63	486	<u>A,C,B,D</u>
1949 „ ...	1708	850	1502	800	Yes	13.91	344	<u>A,C,B,D</u>
Clean coffee ...	2.58	1.32	2.39	1.28	Yes	16.29	1.00	<u>A,C,B,D</u>
1950 Cherry ...	2467	1667	2626	1053	Yes	10.97	1014	<u>C,A,B,D</u>
Clean coffee ...	3.68	2.26	3.91	1.42	Yes	18.76	1.69	<u>C,A,B,D</u>
Average of 11 yrs. (ripe cherry) ...	1687	859	1490	824	Yes	4.98	192.4	<u>A,C,B,D</u>

In eight out of eleven years spraying alone (A) and in seven out of eleven years spraying + pruning (C) have given significantly higher yields over pruning (B) and control (D). The analysis of the average yield for eleven years also shows that treatments A (Spraying) and C (Spraying + pruning) have significantly increased the yields of ripe cherry over that yielded by either B or D. The figures for clean coffee for 1949 show that yield from treatments A and C are significantly superior to A and D.

26. Incidence of floats in relation to pruning and spraying:

During the 1949 and 1950 harvests of the crop in the experiment recorded above, the percentage of 'floats' occurring in a representative sample of cherry from each plot were determined both by volume and weight. The results are furnished below:—

TABLE XXIX.—Percentage of 'floats' in relation to spraying & pruning

TREATMENTS	PERCENTAGE OF 'FLOATS'			
	By Weight		By Volume	
	1949	1950	1949	1950
A. Spraying	8.18	3.9	9.61	3.93
B. Pruning	6.51	4.68	7.92	4.15
C. Spraying + Pruning	8.10	3.9	10.6	3.62
D. Control (no treatment)	9.49	5.20	12.52	5.08
Significant or not	No	Yes	Yes	Yes
Standard error expressed as % of general mean.	14.91	6.81	11.54	2.66
Critical difference (P=0.05)	3.85	0.96	3.75	0.36
Conclusions.	<u>D, A, C, B</u>	<u>D, B, A, C</u>	<u>D, C, A, B</u>	<u>D, B, A, C</u>

In both years, treatment D (control) has given the highest percentage of floats and is significantly greater than B (Pruning) in 1949 and greater than C (Spraying + Pruning) in 1950. In 1949 treatment B has given the lowest 'floats' both by weight and by volume. In 1950 however, treatment C has given the lowest percentage of 'float'. Hence the results are erratic. It is however noticed that there is a distinct fall in the percentage of 'floats' (b) volume) from 1949 to 1950. It is apparent that the float content of a crop depends more on seasonal factors than on the treatments.

27. **Effect of spraying and pruning on bean quality:** The parchment prepared from the samples drawn during the harvest of the experimental plots was hulled and graded and the percentage of 'A' grade beans determined. The results are tabulated below:—

TABLE XXX.—Effect of spraying and pruning on bean quality

TREATMENT	% 'A' grade beans	
	1949	1950
A. Spraying.	22.48	50.75
B. Pruning	25.60	53.25
C. Spraying + Pruning	28.89	49.25
D. Control	24.45	48.75
Significant or not	No	Yes
Standard error expressed as % of general mean.	10.79	5.91
Critical difference (P=0.05)	8.76	3.64
Conclusions	<u>C, B, D, A</u>	<u>B, A, C, D</u>

In 1949, there has been no significant difference between treatments in the percentage of 'A' grade beans. In 1950 however, there is a significant increase in the percentage of 'A' grade beans in treatment C (Pruning + Spraying) and D (control). But it is found from table XXVIII that the average yields of pruned blocks (treatment B) over sprayed blocks (treatment A) is only about half and the slight increase of 'A' grade beans, even if it proves to be a persistent factor, may not confer material benefit to the grower.

28. **Effect of different methods of shading in young clearings:** Different methods of shading adopted in young clearings were tried to assess the relative merits of these methods. Basket plants of S. 288 of similar age and growth were planted in $1\frac{1}{2}$ ft. cube pits, spaced $6\frac{1}{2}$ ft. each way, in a new clearing at Chethalli during the middle of September 1949. Shading was done early in November. A row of *Crotalaria anagyroides* was also sown towards the middle of September in one variant between the rows of coffee in a criss cross fashion. Temperature records were taken under,

the shade in all the treatments from December to May. Growth measurements were taken in respect of the height of the plant, the number of primaries, the number of nodes etc. The results are recorded below.

TABLE XXXI.—Shading experiments in young clearings

VARIANT	No. of plants under each treatment	Average height of plant in last week of April	Average No. of nodes	Average No. of primaries	Average temperature from Dec. to May	No. of plants surviving in May	Percentage of mortality
1	2	3	4	5	6	7	8
<i>Binai</i> leaf hut	... 24	15.31	9.02	4.67	30.60	23	4
Dadap stakes hut	... 24	15.55	10.32	5.65	32.91	21	12
Bamboo thatti	... 24	15.04	9.48	5.32	32.89	22	8
Jungle grass hut	... 30	18.85	10.58	6.23	30.56	29	3
Jungle leaf hut	... 30	17.63	9.98	5.84	30.83	28	7
<i>Crotalaria anagyroides</i> grown all round	... 24	14.77	9.15	6.17	32.45	11	54

Due to the unusual drought between December and the middle of February, there is a small percentage of mortality in all the treatments, but a higher percentage of deaths occurred in plots where *C. anagyroides* was grown allround. This effect is attributable to the competition for soil moisture by the belt of *Crotalaria*. Among the other treatments *Binai* proved unsuitable. It harboured grass hoppers which did considerable damage to the young coffee plants. Plants growing under jungle grass huts and huts of other species than *Binai* appeared more healthy as shown by better growth of plants, greater number of nodes, larger number of primaries and the lower temperature recorded under these shades. Incidentally the cost of providing these shades is lower than for the maintenance of other types. In the use of grass shade however, care has to be taken in gathering clumps before they flower, lest the falling seeds germinate and produce a mat of grass. Another advantage in using these two types of shade is that the material can be used for mulching when the huts are dismantled.

29. The relative merits of bed plants and basket plants:

A small-scale trial was started during the year to study the relative merits of bed plants and basket plants in respect of their growth and survival value. Two plots of 10 cents each were marked, one for each of the selection S. 288 and S. 645. Half the area in each strip was planted to bed plants and the other half to basket plants. In conformity with plantation practice, bed plants which were one year and 3 months old were planted in the middle of July while basket plants which were only 5 months old were put out early in September. For this reason, the results recorded below during the first year of growth are not strictly comparable and only further observations will reveal the relative merits of the two systems. It may however be observed that of the two selections under experiment, S. 645 shows more vigour than S. 288.

TABLE XXXII.—Bed v. basket plants

VARIANTS	Nature of planting material	Number planted	No. living in May 50	Average height record at the end of April 50	Average number of nodes	Average number primaries
S. 645	... Bed plants	30	27	21.98	12.5	20.00
do	... Basket plants	30	24	13.10	9.18	10.00
S. 288	... Bed plants	30	30	18.62	10.67	7.13
do	... Basket plants	30	30	15.48	9.07	5.03

30. **The effect of the age of seedlings transferred from germination beds to plant-baskets:** Seeds of S. 288 were sown in nursery beds in April 1949. The first set of seedlings were transplanted in uniformly prepared nursery baskets on the seventh day after germination when the seed coat was still covering the seed leaves (cotyledons). The second set was transplanted two weeks after germination when the shoots were growing erect, but the seed coat was still covering the cotyledons. The third set was transplanted 21 days after germination when the seed coats were shed and the cotyledons had expanded into green leaves. Growth measurements of the three sets of the seedlings were taken on 30-6-1950. Germinated seed transplanted at the end of first and second weeks proved to be quicker in growth than those planted at the end of 3 weeks as shown in the table below :—

TABLE XXXIII.—Effect of age of transplanting of germinated seed to seedling baskets

	AGE FROM GERMINATION		
	7 days	14 days	21 days
	A	B	C
Mean height of seedlings in inches ...	3.64	3.35	2.62
Standard deviation ...	0.9655	0.9798	0.7331
Standard error ...	0.09655	0.09798	0.07331

The results of the experiments show that transplanting germinated seeds within a fortnight after germination, *i.e.* before the cotyledons turn green, gives better start in the growth of the resultant seedlings. Observations are however continued to see whether the initial start in growth of the first two sets is maintained in the field.

31. **The study of basic yields for standardisation of experimental plots:** To find out the most suitable method of soil management in old coffee, a replicated experiment was laid out in July 1949 on a latin square design. Preliminary yield records were taken from the individual plots in order to standardise the plots prior to carrying out the treatments. The basic yields of the plots are given below :—

Locality:	Chethalli (Coorg).	Area of each plot:
Layout:	6 × 6 latin square.	Gross: 16 × 10 plants.
Variants:	6.	Nett: 14 × 8 plants.
Variety:	Arabica (Coorgs).	
Age:	About 20 years.	Shade Natural mixed shade.

TABLE XXXIV.—Cultivation experiments (Standardisation of plots)

NO.	Symbol.	Proposed treatments.	YIELD PER ACRE	
			Ripe cherry in lb.	Calculated clean coffee in cwt.
1.	A	Plot for trenching 1½ ft. deep ...	711	1·26
2.	B	Plot for ¾ ft. deep ...	813	1·45
3.	C	Plot for renovation pitting ...	618	1·10
4.	D	Plot for light digging ...	488	0·87
5.	E	Plot for heavy digging ...	588	1·05
6.	F	Plot for Control, only removing weeds ...	569	1·01
		Mean ...	631	
		Critical difference ...	464	
		S.E. Mean % ...	24·9	
		Conclusions ...	B, A, C, E, F, D	

The results indicate no significant difference between the basic yields of the plots, but the standard error is high. It is proposed to record the basic yields for 1950–51 also and these data could be utilized to work out the suitable plot size for such field experiments.

32. The behaviour of green manures under established coffee:

Several species of green manure plants were sown in 1948–49 in small strips under similar shade conditions of established coffee. Four periodical sowings were conducted, *viz.* (1) prior to the commencement of the S.W. monsoon in May–June, (2) during September towards the close of the monsoon, (3) in November when dry and bright weather conditions set in and (4) in April immediately after blossom showers. It emanated from these trials that for good germination and successful establishment optimum soil-moisture-temperature-light conditions are necessary. The best combination of these conditions was obtainable after the blossom showers or prior to the commencement of the S.W. monsoon. Sowings done during the above periods helped the seedlings to make some progress in growth and withstand the rigours of the monsoon. Later sowing periods proved unfavourable either due to the excessive wet conditions of the soil and the absence of sufficient diffused light and October–November sowings were affected by inadequate moisture to sustain growth. Compared with their duplicates sown in the open, the growth under shade was distinctly poor with little branching until the plants attain the height of the coffee bushes. The flowering phase was delayed by 4 to 6 months and those with a trailing habit dried up with the onset of the dry weather. Further observations were made in 1949–50 about the progress of the various species and it was gathered from these observations that the best species which proved to be hardy and capable of suppressing weed growth are the following in the order of their mention:—

- a. *Crotalaria anagyroides*.
- b. *C. usaramoensis*.
- c. *Sesbania speciosa*,
- d. *Tephrosia vogelii*.
- e. *T. candida*.

33. **Rejuvenation of old coffee:** An experiment was started both at Balehonnur and Chethalli to assess the relative merits of five different treatments under identical conditions of cultural operations like manuring, weeding and digging. The following are the treatments:—

- (i) Stumping the plants to 18 inches height from the ground level and allowing three suckers to develop multiple stems;
- (ii) Collar-pruning the plants and allowing one sucker to form a main stem on which multiple stems will be developed later;

- (iii) Collar-pruning the plants and raising three suckers to develop multiple stems;
- (iv) Collar-pruning the plants and raising one sucker to form a single stem, and

It was found that collar-pruning in May delays the production of a satisfactory number of vigorous suckers. Therefore a special experiment is to be laid out to determine the optimum period for collar pruning.

34. Time of pitting: In this experiment conducted at the sub-station, it is intended to determine the effect of early pitting and late pitting on the growth of seedlings. The experiment is laid out in A B B A plan.

35. Determination of the quantity of organic matter added to coffee soils under light and heavy shade: Towards the end of the dry weather in April 1950, areas 4' x 4' were marked out at random one in each acre of planted coffee at Chethalli and the leaf mulch within the area collected and weighed. The areas were classified according to the intensity of the overhead shade into 'light' and 'heavy'. The results showed that the average yield of leaf mulch under 'heavy' shade amounted to 4.1 tons per acre as against 2.5 tons per acre under 'light' shade.

36. Single stem v. multiple stem: An experiment was laid out at Balehonnur on A B B A plan replicated six times to study the merits of the multiple stem system of training coffee as against the single stem system. A plot of young coffee, 7 years old, that was trained to the single stem was used for this experiment. The primary branches on one side of the experimental trees were pruned off to encourage free development of healthy suckers. Three vigorous suckers were allowed to develop while the rest were rubbed off. Immediately after the harvest of the standing crop, it is proposed to stump these plants at 18 inches height from the ground level retaining one 'lung' branch. As this block contains 5 blocks of station selections and one of Kent's arabica, it is hoped that the performances of these blocks will, in due course, furnish sufficient data to assess the merits of the two systems of training coffee both on susceptible and resistant selections of arabica coffee. A small-scale experiment has also been started for observational studies on the effect of training robusta under single and multiple stem systems.

TABLE XXXV.—Use of plant hormones on the prevention of fruit-drop

<i>Locality:</i>	Balehonnur	<i>Layout:</i>	Randomised block
<i>Variety:</i>	Arabica (Coorg)	<i>Plot:</i>	One row of eight plants
<i>Treatments:</i>	5	<i>Spacing:</i>	6 ft. x 6 ft.
<i>Replications:</i>	5	<i>Shade:</i>	Natural
<i>Area of Exptl. plot:</i> 16.66 cents			
Dosage of hormone sprayed:—			
A. Planofix = 10 parts per million (M & B Product)			
B. Phymone = —do— —do— (I. C. I. Product)			
C. Fernoxone = 320 parts —do— (—do—)			
D. Methoxone = —do— —do— (—do— , Agroxone liquid = 10% Methoxone)			
E. Control (no treatment)			
Quantity: 350 gallons per acre of 1,200 plants			
Date of application: —11-6-1949.			
<i>Treatments</i>		<i>Percentage of fruits dropped</i>	
A. Planofix	...	43.6	
B. Phymone	...	43.2	
C. Fernoxone	...	66.6	
D. Methoxone	...	61.4	
E. Control	...	39.8	
Sig. or not	...	Yes	
Critical difference	...	13.93	
Conclusion	...	E, B, A, D, C	

At the concentrations used, Fernoxone and Methoxone have adversely affected fruit retention. Further experiments were laid out during May 1950 to see whether the application of the hormones in lower concentrations and at an earlier stage in the development of fruits would produce beneficial effects.

37. **Effect of weed-killers:** Experiments were continued on the study of the relative values of several weedicides in the control of weeds in coffee plantations. The results are furnished in Table XXXVI.

**TABLE XXXVI.—Effect of weed-killers on Coffee Estate
weeds—Balehonnur (Mysore)**

Sl. No.	Weedicides	Strengths used per acre	Period of application	Effect on weeds.
1	Shell weedkiller No. 20	... 20 gals. + 20 gals. Diesel oil	Premonsoon	Effective against all the common weeds and particularly grass and <i>Mimosa pudica</i> . Treatment No. 1 was more effective than treatment No. 2.
2	do	10 gals. + 30 gals. Diesel oil	do	
3	Stanvac weed-killer	... 20 gals + ... 20 gals water	Postmonsoon	do
4	do	14 gals + 28 gals Diesel oil	do	do
5	do	43 gals + 57 gals of water	do	In the plots sprayed there were tall weeds of <i>Gynura angulosa</i> and heavy grass growth. It was not possible to cover fully the entire plant surface and so, the effect of this contact weedicide was negative.
6	do	57 gals + 114 gals Diesel oil	do	
7	Fernoxone	... 1 lb in 50 gals of water	Premonsoon	Very effective against common weeds like <i>Bidens pilosa</i> (Spanish needle).
8	Agroxone	... 1 gal in 100 gals of water	do	Effective against <i>Ageratum conyzoides</i> (Goatweed), <i>Gynura angulosa</i> , especially when they are in seedling stage. No sterilising effect on soil; fresh germination and weed-growth was unhampered.

The mineral oil weed-killers viz. Shell No. 20 and Stanvac are contact weed-killers toxic to all vegetation and therefore require very careful handling to prevent injury to coffee. The cost of the operation at present prices proved more expensive than mechanical weeding by human labour.

38. **Seed germination tests:** Bulk seeds of arabica and robusta prepared under similar conditions were sown fortnightly to study the extent to which germination is inhibited in storage.

Date of sowing.	% germination	
	Arabica	Robusta
1st January 1950	94.7	
15th „ „	86.6	
1st February „	83.5	
15th „ „	90.3	
1st March „	78.3	78.0
15th „ „	82.3	74.0
1st April „	68.7	79.0
15th „ „	59.0	79.0

It was observed in the case of arabica seed which was sown fortnightly for 4 months that, as a rule, delayed sowings take a proportionately longer time to show the first signs of germination and that there was a gradual deterioration in the percentage of germination after the first three months of storage.

39. Abnormal leaf fall and fruit shedding during monsoon:

Due to several difficulties encountered in carrying out all the treatments in a comprehensive experiment laid out at Galekere estate (Mysore) in 1949, the experiment had to be abandoned and a simpler one adopted. The new layout consists of a simple A. B. B. A pattern and has two treatments viz. normal Bordeaux mixture (2-2-40) and excess-lime Bordeaux mixture (2-3-40). The spraying was done on 25-5-50 and the first set of observations on leaf and fruit fall was taken towards the end of the period under report. The experiment is in progress.

IV. PLANT PROTECTION

40. **Organic fungicides:** An experiment was started at Balehonnur in May 1949 to compare Bordeaux (2-2-40) with a modern organic fungicide, viz. Dithane D-14 for the control of 'leaf disease' on coffee.

Locality: Balehonnur

Area of Exptl. plot: 25 cents

Treatments: 2

Layout: A B B A pattern

Replications: 6

Plot size:

Variety: Kents

Gross = 5 x 5 plants

Shade: Natural shade

Nett = 3 x 3 plants

Spacing: 6 ft. x 6 ft.

Treatments:

A.	Dithane D-14, 2 quarts.	} Two sprays, the first on 21-5-49 and the second on 21-6-49.
	Zinc sulphate 1 lb.	
	Hydrated lime $\frac{1}{2}$ lb.	
	Teepol X $1\frac{1}{4}$ oz.	
	Water 100 gals.	
B.	Copper sulphate 5 lb.	} One spray.
	Lime 5 lb.	
	Teepol X $1\frac{1}{4}$ oz.	
	Water 100 gals.	

Observation: Counts of leaves by the random sampling method.

TABLE XXXVII. Organic fungicide v. Bordeaux.

TREATMENTS	Percentage of leaves with leaf disease
A. Dithane D-14.	16.33
B. Bordeaux mixture.	6.17
Significant or not.	Yes
Critical difference.	7.66
Conclusion.	A,B.

Though two sprays of Dithane D-14 were given as against one spray of Bordeaux mixture, the former could not control leaf disease with the result that the leaf-fall and die-back were severe despite treatment. It is obvious that Dithane D-14 cannot replace Bordeaux mixture as a protection against leaf-disease.

41. Time and strength of Bordeaux spray : This experiment is a continuation of the investigations begun in 1944 in three representative localities in Coorg, viz. Kirgandur (N Coorg), Luxmi (Central Coorg) and Gattedhulla (S. Coorg). The main treatments comprised of (1) pre-monsoon spray ; (2) post-monsoon spray and (3) pre-*plus* post-monsoon spray. The sub-treatments consisted of two strengths of Bordeaux mixture, viz. 2-2-40 and 4-4-40 formulae. The efficiency of the treatments in affording protection against 'leaf-disease' was evaluated in terms of 'effective leaf survival' and resultant yields of ripe cherry. A summary of the results was furnished in the last report. The merits of the main and sub-treatments were found to vary from season to season. In order to get a better perspective of the results the data for 1949-50 were analysed in detail to bring out interactions between locality, period of application and strength of mixture. The results are furnished below.

Locality: Coorg

Year: 1949-50

Variety: Arabica (Coorg)

Shade: Natural shade

Layout: Split-plot design

Main replications: 6

Size of plot: Gross - 6 x 16 trees

Nett - 4 x 16 "

Treatments:

Main 3, Sub 2.

Zones 3

TABLE XXXVIII.—Percentage of leaf survival and yields in relation to time, strength and zone

TREATMENTS	Mean effective % leaf-survival Sept.-Oct. 1949	Yield per acre	
		Ripe cherry in lb.	Clean coffee in cwt
	Gen. mean-28.6	2043	3.04
<i>Main treatments :</i>			
A. Pre-monsoon	29.6	1928	2.87
B. Pre-+Post	32.2	2440	3.63
C. Post-monsoon	24.0	1762	2.62
Std. error	4.18		4.03
Sig. or not	Yes		Yes
Critical dif.	3.4	358	0.54
Conclusions	B,A,C	B,A,C	B,A,C
<i>Sub-treatments :</i>			
E. Bordeaux 4-4-40	29.9	2180	3.25
F. do 2-2-40	27.3	1907	2.84
Standard error	1.97		4.96
Sig. or not	Yes	No	No
Critical dif.	1.6	288	0.43
Conclusions	E,F		E,F
<i>Zones :</i>			
K. Kirgandur	28.3	2594	3.86
L. Luxmi	32.8	1956	2.93
G. Ghattedhulla	24.7	1571	2.34
Standard error	4.18		4.03
Sig. or not	Yes		Yes
Critical dif.	3.4	358	0.54
Conclusions	L,K,G		K,L,G

Interactions :— 1st order.

Time × zone	Not sig.	Not sig.
Zone × strength	Not sig.	Not sig.
Time × strength	Significant	Not sig.

Interactions 2nd order.

Time × zone × strength	Not sig.	Not sig.
------------------------	----------	----------

Significant interactions—Sept. leaf counts.

Time × strength			
	A.	B.	C.
E	30.8	35.3	23.8
F	28.5	29.0	24.0
	B,A,C		
	B,A,C		
Standard error	3.41		
Critical dif.	2.8.		
	E,F	E,F	E,F

Leaf counts taken in Feb-March 1949, indicated no difference either due to time of spray or strength of spray. But in respect of zones, Ghattedhulla was superior to Kirgandur and the latter better than Luxmi. In Sept-Oct. observations noted in the table, the order is reversed, Kirgandur continuing to occupy the middle position as in February. In strength of spray, 4-4-40 is found to be better than 2-2-40, while in time of spray pre-monsoon, and pre- and post combined are on a par, but better than post-monsoon. In yields the same order as in last year is noted, Kirgandur ranking first followed by Luxmi and Ghattedhulla. The results taken in conjunction with last year indicate that leaf survival value is consistently good at Kirgandur, which is reflected in better yields, than in the other two localities which are subject to fluctuations in respect of leaf-survivals.

42. Use of 'wetters' and 'spreaders' with Bordeaux mixture :

The experiment in Coorg with different strengths of Teepol X was continued. Results are recorded below :

TABLE XXXIX.—The use of Teepol X as a 'spreader'.

Locality:	Ghattedhulla (Coorg).	Layout:	Randomized
Size of plot:	Gross 4 x 30 plants		block 4 x 6
	Nett 3 x 30 "		
Treatments:—			
	A. Bordeaux 2-2-40.		
	B. do	+ $\frac{3}{4}$ oz. Teepol X in 40 gals.	
	C. do	+ $1\frac{1}{2}$ oz. do	do
	D. do	+ 3 oz. do	do

(a) Leaf counts.

TREATMENTS	Sep 46	Sep 47	Sep 48	Sep 49	Feb 47	Feb 48	Feb 49	Feb 50
A	23.7	23.4	24.6	25.7	11.1	15.7	11.9	10.2
B	32.0	28.5	24.4	32.5	14.3	16.6	13.9	11.7
C	23.2	29.6	25.4	21.7	14.1	18.4	14.7	11.6
D	29.4	29.1	23.2	20.9	14.2	18.1	14.7	11.5
Gen mean	27.1	27.7	24.4	25.9	13.4	16.7	13.6	11.3
Sig. or not	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Standard error	10.92	4.73	6.27	5.40	8.06	5.33	4.01	4.28
Critical difference	6.3	2.8	4.6	4.2	2.3	1.9	1.6	
Conclusions	BDAC CDBA CABD BACD BDCA CDBA CDBA BCDA							

(b) Yield data per acre

TREATMENTS	Ripe cherry in lb.			Clean coffee in cwt.		
	1948	1949	1950	1948	1949	1950
A	... 3520	2683	3680	5.24	3.93	5.47
B	... 4840	2077	4300	7.20	3.09	6.40
C	... 4440	2680	4240	6.61	3.93	6.34
D	... 3680	2930	3200	5.65	4.36	4.76
Gen mean	... 4115	2593	3855	6.13	3.86	5.74
Significant or not	... Yes	No	No	Same	as for	cherry
Standard error	...	16.35		Same	as for	cherry
Critical difference	...	1543			2.30	
Conclusions	... <u>BC,DA</u>	<u>ACDB</u>	<u>BCDA</u>	Same	as for	cherry

Taking September leaf counts, the use of Teepol X in the pre-monsoon spray has shown greater leaf retention in 1946 and 1947, but in 1948 no increase was found over plain Bordeaux. In the observations taken in Sept. 1949, Bordeaux with Teepol X at $\frac{3}{4}$ oz. is found to help greater leaf retention than other strengths. But with an increasing dose there is less survival, 3 oz. being significantly of lower value than the control (A). This is possibly attributable to the greater detergent value of higher doses which helps easier washing out of the protective spray. In dry weather counts, all the three treatments give better results than plain Bordeaux, but the differences are not significant. Yield data also show significant increase with $\frac{3}{4}$ oz. dose over 3 oz. though on a par with control and the $1\frac{1}{2}$ oz. dose. The optimum dose therefore appears to be $\frac{3}{4}$ oz. in the pre-monsoon spray and $1\frac{1}{2}$ oz. in the post-monsoon spray.

43. An experiment which was started to compare Albolineum with Teepol X was continued.

Locality: Ghattedhulla (Coorg). Layout: Randomized blocks
3 x 6.

Treatments: A. Bordeaux 2-2-40.

B. do + 1 oz. Teepol X per 40 gallons.
C. do + 2 oz. Albolineum per 40 gallons.

TABLE XL.—Results of Teepol X and Albolineum as 'spreaders'

Date of observation	A	B	C	Gen. mean	Sig. or not	Std. error	Crit. diff.	Conclusion
LEAF SURVIVAL								
Sep. 1948	22.2	25.8	25.8	24.6	No	7.8	6.0	<u>C, B, A</u>
Sep. 1949	21.8	22.0	23.9	22.5	No	9.4		<u>C, B, A</u>
Feb. 1949	11.9	13.5	11.8	12.4	No	7.3		<u>B, A, C</u>
Feb. 1950	10.0	11.9	13.3	11.7	Yes	7.1	2.7	<u>C, B, A</u>
YIELD 1949 (per acre)								
Ripe cherry in lb.	2563	2653	2993	2737	} No	14.2		<u>C, B, A</u>
Clean coffee in cwt.	3.81	3.95	4.46	4.07				
YIELD 1950 (per acre)								
Ripe cherry in lb.	2860	3380	3700	3200	} No	7.3		<u>C, B, A</u>
Clean coffee in cwt.	4.26	5.03	5.51	4.76				

Leaf survival is slightly better with Albolineum in the counts taken in September 1949. In February 1950, the increase is significant over the control, but on a par with Teepol X. In yields there is no significant difference between the treatments in 1949-50. In 1948-49 too, the results were similar, but in both years Albolineum has given numerically better yields though not to a significant degree. The experiment is being continued for further observations.

44. **Bordeaux mixture v. peronox:** The experiment started in 1946 to compare Bordeaux mixture of 2-2-40 strength with the proprietary preparation Peronox in three strengths was continued.

Locality: Palmad (Coorg.). *Layout:* Randomised block 4 × 6.

Treatments:

- | | |
|--------------------------------------|------------------------|
| A. Bordeaux mixture 2-2-40. | } Two sprays per year. |
| B. Peronox 1 lb. in 40 gals of water | |
| C. Peronox $\frac{3}{4}$ lb. do | |
| D. Peronox $\frac{1}{2}$ lb. do | |

TABLE XLI.—Results of Field experiments—Bordeaux v. peronox

Date of observation	A	B	C	D	Gen. mean	Sig. or not	Std. error	Crit. diff.	Conclusions
LEAF SURVIVAL									
Sep. 1946	24.4	23.8	21.1	24.0	23.3	No	1.60	4.7	A,D,B,C
Sep. 1947	35.6	36.1	32.2	30.2	33.5	No	1.90	5.6	B,A,C,D
Sep. 1948	18.8	11.4	9.2	9.0	12.1	Yes	5.70	2.1	A,B,C,D
Feb. 1947	19.1	20.8	17.6	18.2	18.9	No	1.10	3.2	B,D,A,C
Feb. 1948	17.8	14.8	16.0	14.7	15.8	Yes	0.71	2.1	A,C,B,D
Feb. 1949	13.8	11.1	11.5	11.3	12.0	Yes	5.53	2.0	A,C,D,B
YIELD PER ACRE 1949									
Ripe cherry in lb.	4940	3220	3267	3647	3769	Yes	11.00	1242	A,D,C,B
Clean coffee in cwt.	7.35	4.80	4.87	5.43	5.61	Yes	„	1.85	A,D,C,B
YIELD PER ACRE 1950									
Ripe cherry in lb.	4797	3383	3040	3063	3571	Yes	8.49	916	A,B,D,C
Clean coffee in cwt.	7.14	5.04	4.53	4.56	5.31	Yes	8.49	1.37	A,B,D,C

Out of the three September leaf counts, it is found that Peronox is equal to Bordeaux in the first two years, but fails to be so in the third. In the February leaf counts, there is no difference between Bordeaux and Peronox in 1947. However in 1948 and 1949, Peronox is less effective. According to the yield data, Bordeaux mixture is definitely superior to Peronox and there is no significant difference among the three strengths of Peronox.

45. **Comparison of Bordeaux mixture with copper sandoz:** A new experiment was started at Chethalli during October 1949 to compare the proprietary product, Copper Sandoz with Bordeaux mixture. The strength recommended by the firm is 1 lb. in 40 gallons. A higher strength of 2 lb. in 40 gallons was also included in the trials. The results of first leaf-counts and the yields are given in Table below—

Layout: Randomized block 4 x 5.

Treatments:

A — Control (no spraying).

B — Bordeaux mixture 2-2-40.

C — Copper sandoz 2 lb. in 40 gallons.

D — Copper sandoz 1 lb. in 40 gallons

**TABLE XLII.—Comparison of Bordeaux with Copper sandoz
February 1950 leaf-counts**

Treatment	E,P,L.S.	Sig. or not	Std. error	Crit. diff.	Conclusion
A.	13.5				
B.	17.3				
C.	16.2	No.	7.34	3.6	D,B,C,A
D.	17.5				
Gen. mean	16.1				

It is too early to expect any appreciable effect due to the treatments as the experiment was started recently. Copper sandoz according to the manufacturers is claimed to be miscible and compatible with a variety of insecticide products like Derriphyton, Nicotine and D.D.T., unlike Bordeaux mixture. If this material is found efficient for control of leaf-disease, it can be used to prepare formulations for a combined fungicide and insecticide.

46. Incidence of black bean: To study the possible causes of black-bean in coffee, a small trial was started during the year. One hundred branches were ring-barked and defoliated early in August and an equal number tagged to serve as control without any operation. The treated branches and control were selected in pairs. The final round of picking was completed in January and the data gathered from the examination of two pickings are given below.

TABLE XLIII.—Incidence of black-bean

Treatment	Total fruits	Total beans	Float	Pea-berry	Spotted beans	Empties
Ringed and defoliated	1289	2367	2157	210	36 (1.52%)	36 (1.52%)
Control	1428	2598	2355	245	14 (0.54%)	41 (1.58%)

The treatments have not been found to induce 'black-bean' production as expected, possibly due to the lateness of the operations. The studies have been repeated again, including a few more treatments. These were done early in May following the blossom showers. 100 branches were labelled for each of the following treatments:—

1. Bearing branches completely defoliated.
2. Bearing branches not defoliated but ring-barked at every internode.
3. Bearing branches not defoliated but ring-barked at every node and also completely defoliated.
4. Control—bearing branches neither defoliated nor ring-barked.

The beans will be examined during the picking season.

47. Coffee pests: The experiment started in 1946 for the control of white stem borer was continued using the modified treatments for the application of D.D.T. and B.H.C. (Benzene hexa chloride) as noted below:

D.D.T.		B.H.C.	
70 to 80% Technical	... 4 lb.	50 % B.H.C. with 6.4 %	
Gum arabic	... 2 oz.	of the Gammai somer	... 4 lb.
Gelatine	... 2 grm.	Water	... 40 galls.
Water	... 40 galls.		

Two rounds of borer infested trees were removed during the year—August 1949 and March 1950—and burnt. The data collected are given in the table:

TABLE XLIV.—Insecticidal control of stem-borer

Locality : Margolly (Coorg).

Layout : Randomized block replicated 15 times.

		TREATMENTS		
		D.D.T.	B.H.C.	Control
1.	Original number of trees marked	... 2179	2194	1601
2.	Number of trees removed in 1949-50	... 107	98	199
3.	Percentage of infection in 1949-50	... 4.91	4.47	12.43
4.	Progressive number of trees removed	... 276	192	453
5.	Progressive percentage of infection from 1946 to June 1950	... 12.66	8.75	28.29

It is found from the results that of the two chemicals B.H.C. gives better protection than D.D.T.

48. Two sets of new experiments were started for the study of the control of borer, one at Chethalli and the other at Biccode (Mysore), where borer infection is found to be very high. The same formulations of D.D.T. and B.H.C. as at Margolly were used. The first application of the chemicals was made in October 1949 and the records of bored trees were taken in April 1950.

TABLE XLV.—Borer control with chemicals

LOCALITY	PARTICULARS	D.D.T.	B.H.C.	Control
<i>Chethalli</i>	Total No. trees treated	... 1109	1074	1061
	Total bored trees removed	... 50	34	46
	Infested trees percentage	... 4.51	3.17	4.34
<i>Biccode</i>	Total No. trees treated	... 1540	1568	1542
	Total bored trees removed	... 105	111	207
	Infested trees percentage	... 6.82	7.10	13.42

It is too early to expect any appreciable effects due to the applications of the chemicals, as the experiment was started only in October 1949.

V. MISCELLANEOUS CROPS

49. **Paddy :** Paddy was grown over an area of 5.9 acres at Chethalli and about 2 acres at Balehonnur. The following yields were obtained:

	Grain Seers.	Straw lb.
Chethalli	... 8437	20,000
Balehonnur	... 1045	8,000

The yield of the wetlands at Chethalli has gradually increased from about 4,500 seers in 1947-48 to 7,087 seers in 1948-49 and to 8,437 seers in 1949-50. Out of the produce at Chethalli Station, 1425 seers of seed paddy of the strain G.E.B. 24 was sold to the Coorg Agricultural Department.

50. **Oranges:** Twenty five acres are in bearing at Chethalli. The monsoon crop was poor, but the cold weather crop was fairly good. 89,000 oranges were picked from about 19 acres and sold through the Orange Growers' Co-operative Society, Pollibetta, realising Rs. 2,543-3-0. The usufruct of the remaining 6 acres was sold for a sum of Rs. 1,400. Including minor sales to the staff, a sum of Rs. 3,943-3-0 was realized. The orange area also has gradually improved and the income has consistently increased from Rs. 650 in 1947-48 to Rs. 1,182-13-0 in 1948-49 and to Rs. 3,949-3-0 in 1949-50.

51. **Green manures:** (a) The following quantities of seeds were collected from green manure plots at Chethalli:

	lb.	oz.
<i>Crotalaria anagyroides</i> ...	99	0
<i>C. lanata</i> ...	...	9
<i>C. usaramoensis</i> ...	1	8
<i>C. striata</i> ...	1	10
<i>C. agatiflora</i> ...	4	5
<i>Crotalaria grahamiana</i> ...	2	9
<i>Cassia hirsuta</i> ...	4	0
<i>Tephrosia candida</i> ...	...	15
<i>T. vogelei</i> ...	1	4½
<i>Wild diancha</i> ...	...	9
<i>Crotalaria fulva</i> ...	...	12
<i>Indigofera arrecta</i> ...	1	0
TOTAL ...	118	1½

(b) At Balehonnur, the seed of the various green manure plots were collected and utilized for further sowings. The surplus seeds at both stations were sold to coffee planters.

52. **Fibre crops:** At Chethalli, 400 lb. of the stem of *Crotalaria anagyroides* were cut at the early flowering stage, retted and the fibre extracted. This yielded about 4 per cent of fibre by weight and the quantity was sent to the Secretary, Jute Committee, Calcutta, for technological tests.

53. **Cotton:** (a) At Balehonnur, specimen crops of *St. Vincent* and *Montserrat* (Sea Island cottons), and *Moco* and *Queberdinho* (perennial cottons) were grown.

(b) A small area on the higher slopes of the wet land at Chethalli was planted to the following specimens of perennial cotton:

Moco, Queberdinho, Barbadosense (types 1, 2, 3, & 4).

The behaviour of these types of long stapled cottons and their growth habits are being recorded in order to assess the possibilities of growing cotton as a sideline in coffee plantations.

54. **Jute:** Two trial plots of 2½ cents each were sown at Balehonnur in May 1950 to two species of Jute (*C. capsularis* and *C. olitorius*). The crops are under observation.

55. **Fruits and vegetables:** Young plants of apple, peach, pear, mangosteen, durian and nutmeg are making satisfactory growth. Tree-tomato, cape goose-berry, papaya, passion fruit and sapodilla were in bearing and the produce was sold. Vegetables were grown on a small-scale to meet the domestic needs of the residents of the two stations.

56. **Subsidiary food-crops:** Specimen crops of tapioca, sweet-potato, elephant yam, Chinese yam, Javanese yam, Alocacia, Colacacia, Coleus, Irish potato etc., were raised on the station and formed exhibits shown to coffee planters at the Field-day celebrations.

57. **Shade trees:** Seedlings of two African species *Maesopsis eminii* and *Erythrina tomentosa* were planted in the field and are making satisfactory

growth. An unnamed species of *Cordia* having been reported from Uganda to make the best shade for coffee, the seedlings of the South Indian species *Cordia myxa* were raised at Balehonnur to try out the merits of this species as a shade tree.

58. Sixty tung oil plants out of 71 planted during the previous season are making satisfactory growth. Some produced a crop of flowers, but as the plants were too young for bearing, the flowers were rubbed off.

VI. FARM MANAGEMENT

59. Both stations continued to be subscribing members of the U.P.A. S.I. and its Labour department, and also of the regional Planters' Associations.

60. The average strength of the labour and the average turn-out during the period under report were as follows :

		Labour 1-7-49	strength on 30-6-50	Average turn-out per day
Balehonnur	...	131	95	84.0
Chethalli	...	128	89	101.5

In consonance with local practice, foodgrains were purchased and stored at both stations and supplied to the labour force at concessional rates.

61. **Medical facilities:** The health of the staff and labour force of both stations continued to be satisfactory. Medical aid at both stations was rendered as previously by the part-time services of the local medical officers of the Mysore and Coorg Governments. The anti-malarial squad of the local administrations attended to periodical D.D.T. spraying of all estate quarters. This was supplemented by other preventive measure like the regular administration of paludrine.

62. **Sanitation:** All labour quarters at both stations were provided with bore-hole latrines.

63. **Manuring:** The following table furnishes the areas manured during the year under report :

STATION	Period	Area acre	MANURE APPLIED	Rate per acre
Balehonnur	Oct. 1949	2.00	Lime	... $\frac{1}{2}$ ton
	— do —	9.25	Cherry husk ash applied in shallow trenches between rows	... To yield 40 lb. K_2O
	— do —	44.00	NPK Mixture preparation. Nitro- gen half as groundnut cake and	... 40-30-40
	April 1950	15.00	half as ammonium sulphate	...
	May 1950	3.00		
	June 1950	20.00	Nitrogen, pre-monsoon manure in the form of groundnut cake	... To yield 40 lb. of N.
Chethalli		32.00	Lime	... $\frac{1}{2}$ ton
		27.50	NPK	... 40-30-40
		11.00	NP	... 40-30

64. **Spraying:** Spraying arabica coffee with 2-2-40 Bordeaux mixture was done on both stations as per details below :

	Post-monsoon Acres	Pre-monsoon Acres	Mixture
Balehonnur	66.25	70	Bordeaux mixture, 2-2-40
Chethalli	67.00	27	— do — ($1\frac{1}{2}$ acres under copper sandoz trials)

65. **Borer control:** 5,115 borer infested trees at Balehonnur and 9,360 trees at Chethalli were removed and destroyed during the anti-borer operations.

66. **Harvest:** The following are the harvest figures for the two stations :

	BALEHONNUR			CHETHALLI	
	Arabica Bus. Srs	Robusta Bus. Srs.	Other coffee	Arabica Bus. Srs.	Robusta Bus. Srs.
Parchment ...				395 - 6½	
Dry cherry ...	1258	242	22 6	188	127
Gleanings ...	121-25½	7-20		26-13½	
TOTAL ...	1379-25½	249-20	22 6	609-20	127
Estimated yield of clean coffee ...	13 tons.			7.5 tons	

VII. GENERAL

67. **Equipment of laboratories:** A sum of Rs. 20,096 was spent for the purchase of laboratory equipment out of which Rs. 3,035 was spent at the sub-station while the balance was spent at the headquarters station.

68. **Conferences and Exhibitions:** (a) *Field-day:* This institution was revived after a lapse of 12 years. The field-day was held on the 25th November 1949 at Balehonnur and visitors started arriving from the previous evening. The object of the function was to afford coffee planters an opportunity to see first-hand the research activities of the station and for a mutual exchange of ideas between the research team and the coffee growers. The day started with conducting the visitors in convenient batches to the experimental plots and explaining to them the purpose of various investigations and the results achieved so far. After lunch, the visitors and the staff of the research station assembled at a gathering where various aspects of coffee culture were discussed and questions arising from the discussions were answered. Over 150 visitors were present representing various coffee districts and complimentary sentiments were expressed by the visitors appreciating the revival of the field-day and a general desire for such meetings to be held at intervals for the mutual benefit of the planting community and the research team.

(b) The research department participated in the Scientific conference and exhibition held at Coonoor in connection with the Annual Conference of the U.P.A.S.I. The following papers were contributed to the conference by the officers of the research department:—

Subject	Author
1 Manurial Experiments on Coffee ...	K. M. Thomas
2 A Brief History of Coffee Breeding in S. India...	R. L. Narasimhaswamy
3 Breeding for Resistance to Pests & Diseases in Arabica Coffee ...	S. Sundaram
4 The control of Leaf Disease of Coffee in relation to the time of application and the strengths of Bordeaux Mixture ...	T. V. Pattabhiraman

69. **Ad hoc Committees:** Three meetings of the *ad hoc* committee for Balehonnur and 5 meetings of the committee for Chethalli were held during the period. The subject of the deliberations of these committees covered practically all the activities of the station, particularly those pertaining to the building programme, estate management, maintenance of accounts and

research problems that arose from time to time. The proceedings of these meetings were regularly communicated to all members of the research committee. It is a matter of pleasure to record that the advice and suggestions of these committees have been an invaluable asset to the Research Department.

70. Staff meetings: Five staff meeting were held at the headquarters station for formulating general policies of the research department administrative matters and the social life of the station. All officers of the headquarters station and the senior officers of the sub-station attended these meetings.

71. Library: Besides journals received on an exchange basis, 25 scientific journals were subscribed for. Forty-four volumes were added to the library. The total expenditure on library was Rs. 1,607-5-6.

72. Correspondence: The number of correspondence dealt with during the year at the headquarters station was as follows.

No. of letters received	... 4892
No. of letters despatched	... 7171

Total ... 12063

73. Audit of accounts: The accounts of the two stations were audited by Messrs. Fraser & Ross, Bangalore.

74. Publications: The quarterly reports of the research department depicting the salient features of the progress of work at the two stations were regularly published in the *Indian Coffee Board Monthly Bulletin*. The following contributions were made to the Coffee Board Bulletin:—

Subject	Author
1 Black-rot of coffee	... K. M. Thomas
2 Whither manuring?	... do
3 Coffee eelworm	... T. V. Pattabhiraman
4 Use of urine extract in vegetative propagation of coffee	... K. S. Gopalakrishnan and T. V. Pattabhiraman
5 Coffee berry borer (<i>Araecerus fasciculatus</i>)	... Syed Usman

Besides these, publicity was given to such of those questions and enquiries received from coffee growers and the answers sent to the individual parties, but which formed matters of general interest to the coffee industry.

75. Acknowledgements: The writer of this report has pleasure in acknowledging the courtesy and consideration he has received from the office-bearers of the Board, members of the research and ad hoc committees and from the planting community in general. But for their indulgence, assistance and co-operation, it would not have been possible to achieve the progress that is recorded in this report. To the various grades of executive and ministerial officers at the two research stations, he owes a debt of gratitude for their unstinting co-operation and hard-work put in by them under exacting conditions of living and travel. To the various scientists in India and abroad who exchanged their publications and valuable plant material with him he owes his thanks. He has to express his special appreciation of the labour of love which Rao Bahadur V. Ramanathan and Dr. D. V. Bal, the members of the Expert Committee, undertook in studying the available literature on coffee and wading through the records of work available to them at the research stations. Their labour has proved to be a great asset to the Research Department of the Board in that besides it having cemented long established personal friendships between them and the writer, it afforded him unique opportunities for discussion and resultant erudition on a variety of intricate problems relating to coffee research, and culminated in a thorough re-orientation of the research programme of the Department.

K. M. THOMAS,
Director of Research.

APPENDIX I

Rainfall record of the Coffee Research Station, Balehonnur (Mysore)

MONTH	RAINFALL RECORDED IN INCHES DURING										Average for 10 years	Rainfall re- corded in 1949-50
	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49		
July	37.73	29.94	32.16	45.95	47.43	41.61	37.52	35.80	35.97	30.93	37.50	24.60
August	18.82	33.85	21.31	20.14	9.89	10.09	10.72	37.93	30.34	39.49	23.39	25.52
September	3.59	3.07	5.34	5.39	16.11	2.92	9.11	11.51	9.80	6.43	7.33	14.80
October	13.09	7.71	8.76	7.18	15.29	12.42	4.25	3.56	2.62	6.80	8.17	7.99
November	3.83	7.05	0.21	0.21	2.53	2.71	1.08	7.04	1.14	8.59	3.44	1.43
December	0.00	0.70	2.22	1.37	0.01	0.07	0.00	1.09	0.91	0.08	0.65	0.00
January	0.00	0.05	0.00	0.47	0.03	0.00	0.00	0.36	0.26	0.00	0.12	0.02
February	0.08	0.00	0.00	0.00	1.00	0.00	0.03	0.00	0.00	0.00	0.11	0.74
March	0.00	1.05	0.00	0.15	0.60	0.00	0.52	1.86	0.19	0.44	0.48	0.00
April	2.84	1.66	4.63	2.06	1.04	3.92	9.05	1.56	9.94	2.16	3.89	0.79
May	6.77	4.46	5.49	11.76	5.78	2.73	4.28	5.21	2.41	6.61	5.55	3.77
June	22.91	24.34	19.52	13.47	7.81	8.65	23.53	9.90	15.67	10.50	15.63	11.57
TOTAL	109.56	123.88	99.64	108.15	107.52	85.82	100.09	125.82	109.25	111.43	106.26	91.23

APPENDIX II

Rainfall record of Coffee Research sub-station, Chethalli (Caorg)

MONTH	RAINFALL RECORDED IN INCHES DURING										Average for 10 years	Rainfall recorded in 49-50 in ins.
	1939-40	1940-41	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	1947-48	1948-49		
July	21.93	23.50	16.06	26.93	31.45	36.00	30.84	10.71	23.35	12.43	23.32	15.35
August	14.26	18.20	12.91	12.29	4.69	4.93	7.64	24.91	18.85	21.51	14.02	8.83
September	2.94	2.96	6.36	3.91	8.91	1.83	3.50	8.25	8.64	3.59	5.09	5.87
October	10.58	7.10	4.22	5.84	11.50	6.04	4.63	3.93	9.98	3.64	6.75	8.85
November	5.06	8.39	1.42	0.42	6.55	4.00	2.09	6.16	0.13	5.22	3.94	0.10
December	0.00	0.67	1.88	1.01	0.00	0.51	0.00	2.31	1.05	0.09	0.75	0.00
January	0.02	0.00	0.00	1.24	0.00	0.00	0.00	0.00	0.50	0.03	0.18	0.00
February	0.00	0.00	0.00	0.16	1.05	0.00	0.00	0.72	0.40	0.00	0.23	0.71
March	0.00	4.61	1.78	0.42	0.33	0.00	2.02	0.00	0.00	0.02	0.92	0.00
April	6.55	3.70	3.02	2.16	0.87	7.38	8.32	1.53	4.75	3.78	4.21	1.18
May	4.90	5.10	8.55	11.78	1.40	2.29	1.35	4.69	3.80	11.02	5.49	3.71
June	22.02	19.24	14.77	9.10	7.02	10.35	13.59	7.31	10.53	6.85	12.08	6.83
TOTAL	88.26	93.47	70.97	75.26	73.77	73.33	73.98	70.52	81.98	68.18	76.98	51.43

APPENDIX III

Meteorological data observed at the Coffee Research Station, Balehonnur (Mysore) during 1949-50

Sl. No.	METEOROLOGICAL OBSERVATION	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	REMARKS
1.	Highest maximum temperature °F	79.5	80.5	77.5	82.1	82.5	82.5	85.1	87.1	92.0	94.2	92.0	82.5	
2.	Lowest maximum temperature °F	69.5	70.5	67.5	76.0	76.5	76.5	76.5	80.5	85.5	86.0	74.5	70.5	
3.	Highest maximum temperature °F	67.4	67.0	66.6	68.0	67.5	59.5	64.0	64.4	65.3	69.5	69.0	69.0	
4.	Lowest maximum temperature °F	64.0	65.0	61.5	60.5	52.0	50.0	54.0	55.2	59.0	62.0	61.5	63.5	
5.	Average maximum temperature °F	74.3	74.2	73.3	79.5	79.7	79.5	81.8	84.1	88.3	90.1	81.0	73.8	
6.	Average minimum temperature °F	66.0	66.0	64.5	64.5	59.1	56.0	58.2	59.7	59.5	64.0	67.0	66.2	
7.	Highest number of hours of bright sunshine	4.30	5.30	7.00	10.00	11.00	10.30	10.48	10.00	10.30	11.00	11.30	7.2	
8.	Lowest number of hours of bright sunshine	0.0	0.0	0.0	1.10	5.30	8.30	7.00	6.30	7.30	1.42	0.00	0.00	
9.	Average number of hours of bright sunshine	1.7	2.11	2.45	6.10	9.37	10.00	9.00	9.20	9.32	8.30	8.80	2.50	
10.	No. of days on which rainfall was below 10 cents	3	3	2	5	2	...	1	...	...	2	5	2	
11.	— do — between 10-50 cents	14	14	10	4	2	...	...	...	...	2	6	11	
12.	— do — between 50-100 cents	4	5	7	3	1	...	...	1	...	...	1	7	
13.	— do — between 1-2 inches	5	3	6	2	...	...	...	...	...	...	1	2	
14.	— do — above 2 inches	4	3	...	1	...	...	...	...	...	...	...	1	
15.	Total rainfall in inches	24.60	25.52	14.80	7.99	1.43	...	0.02	0.74	...	0.79	3.77	11.57	
16.	No. of rainy days during the month	30	28	26	15	5	...	1	1	...	4	13	23	
17.	Highest rainfall during the month	3.19	7.08	1.71	2.27	0.65	...	0.02	0.74	...	0.46	1.56	2.76	

PRINTED AT THE C.L.S. PRESS
BANGALORE 1
1951